OPERATING INSTRUCTIONS

MODEL 783G
10 NANOSECOND
TIME INTERVAL COUNTER

MP MASTER
MA29724

ELDORADO ELECTRONICS

601 Chalomar Road Concord, California U.S.A. / Telephone: (415) 686-4200

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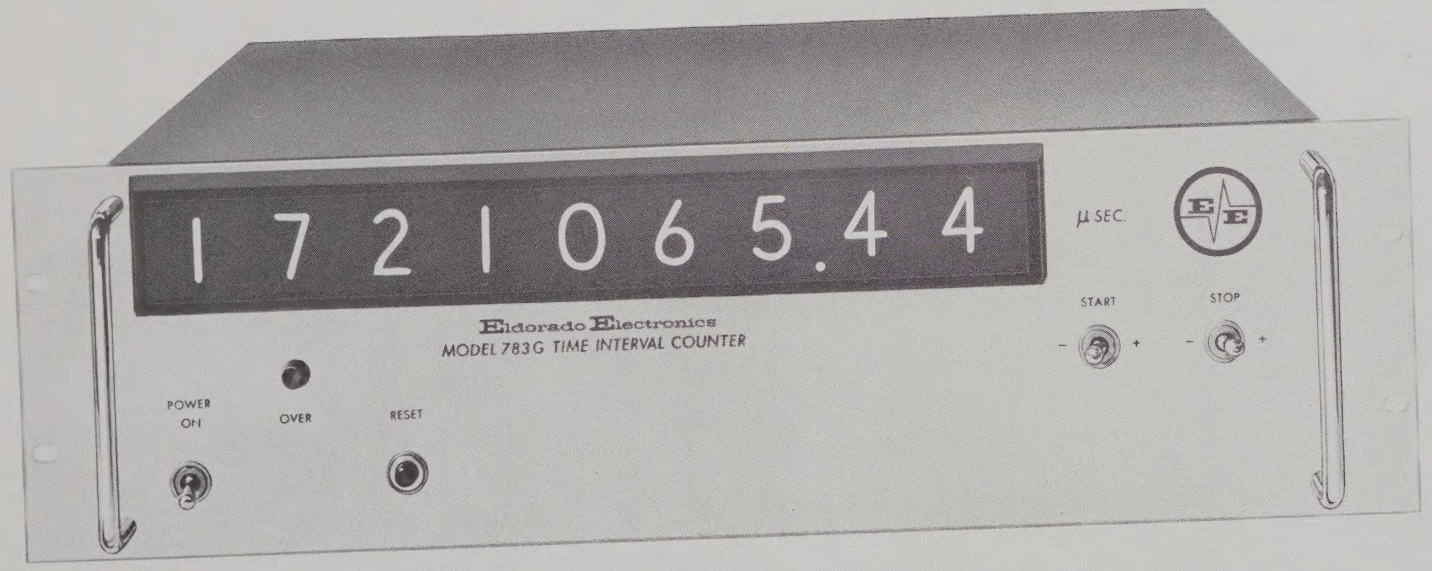
WARRANTY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μ SEC.
Eldorado Electronics
MODEL 783G TIME INTERVAL COUNTER
START
STOP
POWER ON
OVER
RESET

SECTION 1
SPECIFICATIONS

DECADES	Up to 9 decades, 7 decades standard.
DISPLAY	Inline Nixie[R] tubes with fixed decimal point and polarized window filter.
RANGE	10 nanoseconds to 10 seconds or less, depending on number of decades.
RESOLUTION	10 nanoseconds.
MINIMUM INTERVAL	10 nanoseconds.
ACCURACY	±10 nanoseconds, ± time base accuracy.
TIME BASE	
Internal:	1 mc oscillator, options B or C, (internal plug-in).
External:	1 mc oscillator, externally connected to rear panel BNC connector.
Multiplier:	100X frequency multiplier operates from external or internal 1 mc oscillator. Input 0.5 volt p.p., 1K ohm impedance.
Monitor output:	1 mc available from frequency multiplier on rear panel BNC connector. Output 1.0 volt p.p. into 600 ohm load. Provides external time base for one additional counter.
START-STOP CHANNELS	
Impedance:	50 ohms nominal.
Amplitude:	±2 to ±10 volts, overload to ±40 volts will not damage inputs.
Minimum pulse duration:	10 nanoseconds.
Trigger point stability:	±0.1 volt. Better than 10 millivolts at 23°C ambient.
Polarity:	Positive or negative, selectable by front panel switches.

[R] Burroughs Corporation

Slope:	25 nanoseconds per volt or faster.
Connectors:	GR Series 874, located on rear panel.
RESET	
Manual:	Front panel push button.
Remote:	10 volt negative pulse, 1 microsecond minimum duration, through rear panel BNC connector.
LOCKOUT	Additional pulses on either start/stop line will not affect previous reading. Instrument must be reset before further measurements can be made.
REPETITION RATE	Successive readings can be made at rates up to 20 kc.
PRINTOUT	1-2-4-8 BCD; dc levels, "0" = (-)0.4 volts or less. "1" = (-)5.0 volts nominal.
TEMPERATURE	0°C to 50°C.
PHYSICAL SIZE	
Dimensions:	5 1/4" high, 19" panel, 17" wide, 17" deep.
Weight:	25 pounds.
POWER	115/230 vac, 50/60 cps, 160 watts.
OPTIONS	
B.	Internal oscillator with 1 part in 10^7 per 24 hour stability.
C.	Internal oscillator with 1 part in 10^8 per 24 hour stability.
M.	Front mounted input connectors.

SECTION 2
APPLICATIONS

2.1 GENERAL

The Model 783G 10 Nanosecond Time Interval Counter effectively measures intervals from 10 nanoseconds to 10 seconds in 10 nanosecond steps. The measurement is made in the interval between START and STOP control pulses, each of which is connected to the instrument from separate control lines. Signal polarity of these control signals may be either positive or negative as selected on the front panel.

The instrument time base is normally free-running at all times. When a START pulse arrives, it opens the timing gate and allows the counting chain to totalize the time base signal pulses. Totalizing continues until a STOP pulse arrives to close the timing gate, at which point the counting process ceases. The total number of time base pulses displayed on the readout tubes after the "gate open" period ends represents the number of 10 nanosecond intervals which occurred between the START and STOP control pulses. After the visual reading is noted the instrument is reset preparatory to making the next measurement.

Many types of mechanical and electrical phenomena fall within the measurement range of the Model 783G, some of which are briefly discussed here. In each example, the item of prime interest is the time interval between initiation and termination of the event.

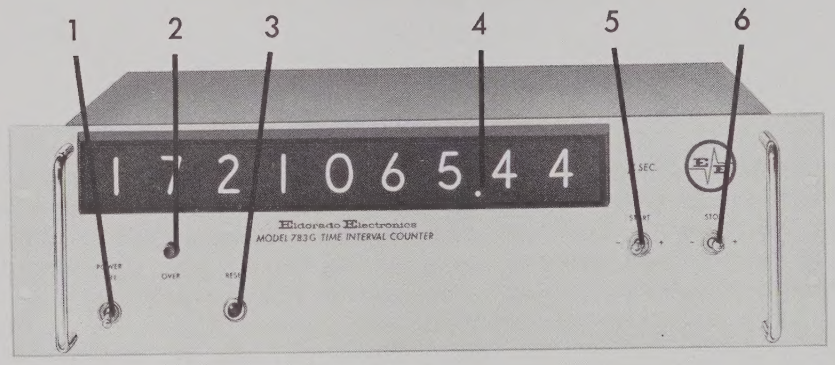
2.2 APPLICATIONS

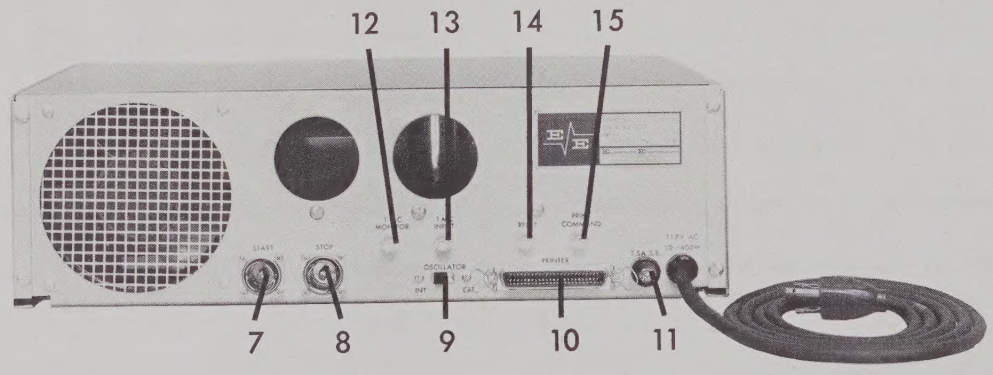
ELECTRICAL PHENOMENA - Model 783G may be utilized to determine pulse delay in a cable or delay line and can accurately resolve pulse duration down to 10 nanoseconds. System pulse jitter measurements may be performed on such installations as radar, navigation and computer equipments. In addition, these measurements can be expanded to include the effects of temperature, humidity, vibration, variations in line voltage and others.

When operated with a high accuracy time base, the instrument is very effective as a calibration standard for such laboratory instruments as digital delay generators. Also, it may be incorporated into radar or navigational systems for direct reading of target or position data. Calibration of these systems by TIM methods is rapidly becoming a standard procedure in the industry today.

MECHANICAL PHENOMENA - High or low speed shaft rotation and high speed camera shutter measurements using phototube techniques, or the study of gaseous and liquid dynamics are other examples of applications for Model 783G.

Muzzle and ballistic velocity, acceleration timing of test vehicles, or shock wave data from laboratory and field experiments may be accurately measured and the results read directly by the operator. In addition, solid or gaseous explosive burning rates may be determined with equal precision. Other applications of the type indicated presently exist for this instrument. As technology continues to advance in various fields, instruments such as Model 783G will find wide and very commonplace usage.





MANUAL CONTROLS

1 POWER switch.

2 OVERFLOW indicator lamp lights when readout register exceeds capacity.

3 RESET button. Resets instrument for next reading.

4 Decimal point is fixed. Readings are in microsecond units.

5 START polarity switch. Set for positive or negative going input control signal.

6 STOP polarity switch. Set for positive or negative going input control signal.

7 START input channel. See SECTION 3 for interconnecting information.

8 STOP input channel. See SECTION 3 for interconnecting information.

9 OSCILLATOR switch. Turn to INT or EXT depending on time base source being used.

10 PRINTER output connector. Visual readout available in 1-2-4-8 BCD format.

11 LINE FUSE, 1.5 amp S.B.

12 1 MC MONITOR output connector. Provides time base signals for one additional Model 783G.

13 1 MC INPUT connector. Accepts time base signals from external source.

14 RESET connector. Accepts reset signals from remote source.

15 PRINT COMMAND connector. Signals from external source are coupled internally to PRINTER output connector.

SECTION 3
OPERATING INSTRUCTIONS

3.1 GENERAL

Model 783G Time Interval Counter is designed to count 100 mc pulses derived from either an internal or external 1 mc frequency standard. Output from a rear panel connector marked 1 MC MONITOR provides external time base signals for one additional counter. Readings are in microsecond units with display resolution down to 10 nanoseconds. The visual readout consists of from 3 to 9 display tubes and a fixed decimal point mounted behind a polarized viewing screen.

A front panel overflow lamp indicates when the register has exceeded its capacity. By observing when the overflow point is reached, it is possible to double the readout capacity since counting will continue uninterrupted into a new cycle.

The input START/STOP control circuits are designed to operate over a range of 2 to 10 volts with either positive or negative polarity on 50 ohm matched lines. Levels up to ±40 volts at either input will not damage circuits regardless of front panel polarity switch settings. Connectors for the START/STOP function are normally mounted on the rear panel but can be located on the front panel as an optional feature.

After each measurement the instrument must be reset before another reading can be made. This is due to a lockout feature on the STOP channel that is actuated as the stop signal is received. When the lockout circuit is operating, additional or random signals on the input lines cannot produce false triggering.

The RESET function for Model 783G is actuated manually by the front panel pushbutton or remotely through the rear panel BNC connector. When operated remotely, this function cannot exceed a repetition rate of 20 kc.

3.2 INPUT SIGNAL CONNECTIONS

In the nanosecond time measuring range, trigger level stability of the START/STOP channels can drastically affect measurement accuracy. To overcome this problem, Model 783G trigger level stability has been designed to provide ±10 millivolt operation at 23°C or ±0.1 volt operation over the entire temperature range of 0°C to 50°C. This insures a high degree of accuracy and repeatability provided that input signal requirements are met.

A careful analysis of START/STOP signal risetime, slope, and amplitude characteristics should be made before operating the instrument to insure correct readings. In addition, it is important to provide proper cabling and impedance matching for these input signals.

The Model 783G START/STOP control circuits must be connected into a 50 ohm matched system using General Radio Series 874 connectors. Normal control channel input is from two separate cables, one for the START signal, the other for the STOP signal. In some instances, it is also possible to utilize the signals from

one input line if they are properly differentiated and both channels are isolated by a 50 ohm matching T-pad.

3.3 INSTALLATION

a. Connect the line cord to a 115 volt, 50/60 cps power source.

b. Connect the START/STOP input control cables to the GR Series 874 connectors. Provide 2 to 10 volt signals of either polarity to the inputs. The pulse slope should be 25 nanoseconds per volt or faster while the pulse duration can be no less than 10 nanoseconds.

c. Connect the remote reset function to the rear panel BNC connector marked RESET. Supply a negative input pulse of 5 to 10 volts with duration of at least 1 microsecond. Successive readings can be made up to a 20 kc recycle rate.

d. OPTIONAL: Connect the print readout cable to the rear panel BNC connector marked PRINTER. The printer output code is 1-2-4-8 BCD from a 10K ohm source, "0" = (-)0.4 volt or less; "1" = (-)5.0 volts nominal. (See SECTION 7, DRAWING INDEX AND DRAWINGS, for connector pin designation information).

If remote control of the printer command function is desired, connect a cable to the rear panel BNC connector marked PRINT COMMAND and provide input pulses of the amplitude and polarity required for operation of the printer.

e. Time base input to Model 783G may be an internal 1 mc plug-in crystal oscillator (OPTION B or C), or an external 1 mc high accuracy signal connected to the rear panel BNC connector marked 1 MC INPUT. External input signals to this connector must have an amplitude of 0.5 volts peak to peak from a 1K ohm source. The rear panel selector switch marked OSCILLATOR must be turned to INT or EXT depending on which frequency source is being used. A 1 mc output signal at the 1 MC MONITOR BNC connector provides a 1.0 volt peak to peak signal into 600 ohms that may be used for external purposes or as the time base for another Model 783G instrument.

3.4 OPERATION

a. Turn the POWER switch to ON. A random display will immediately appear on the readout tubes.

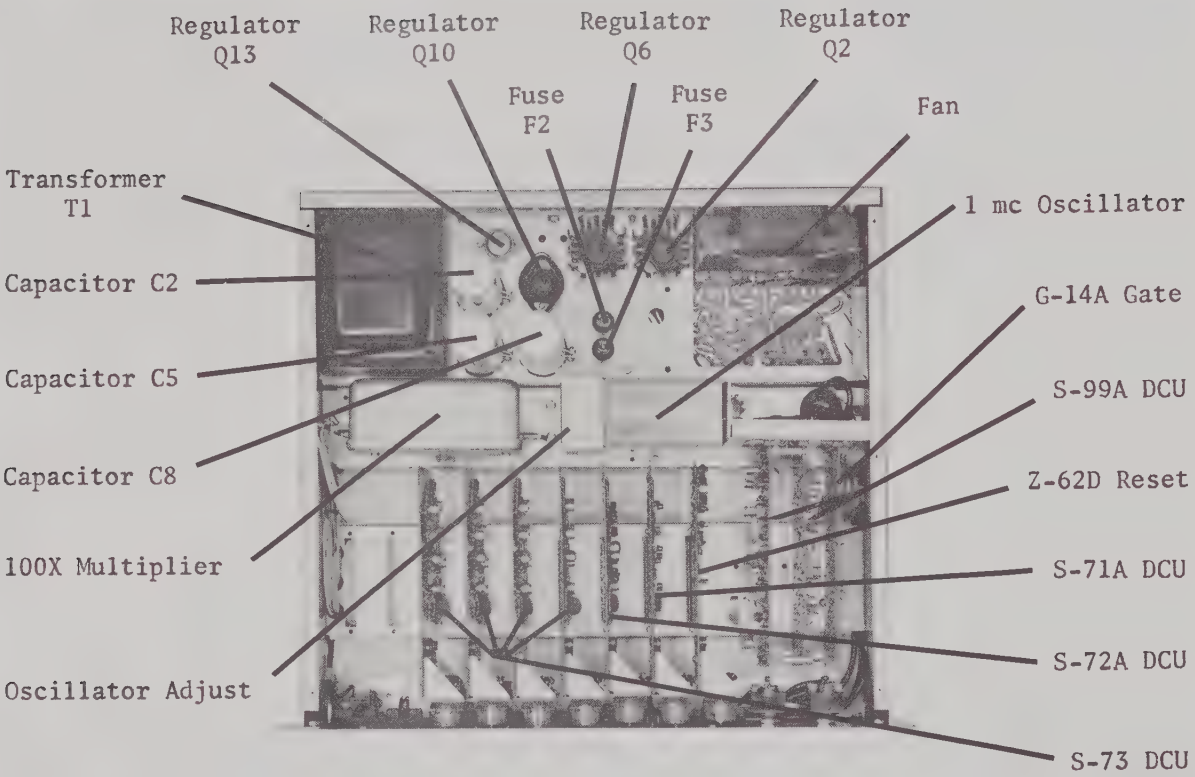
b. Turn the START/STOP polarity switches to the required setting.

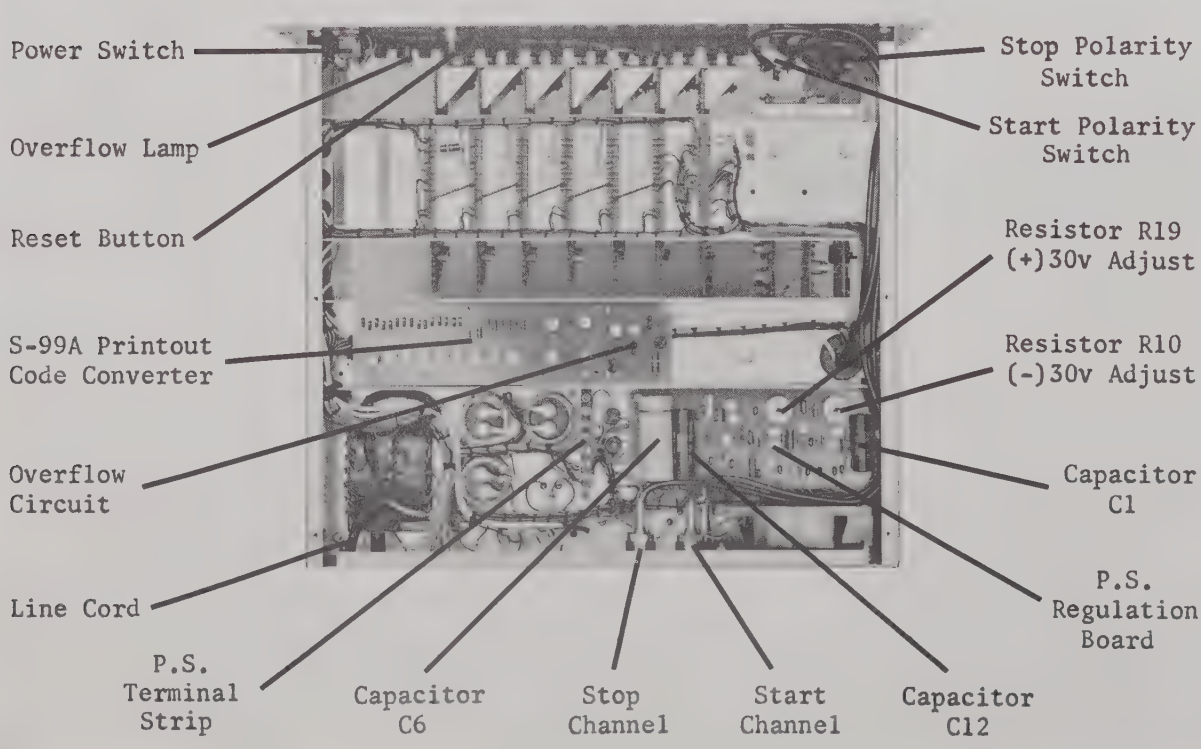
c. Depress the RESET button. All readout tubes should reset to the zero condition. A REMOTE RESET signal should produce the same effect.

d. Introduce START/STOP control signals to the instrument. The reading obtained will remain until the unit is reset. Any signals arriving on the input control lines after the first STOP pulse will have no effect due to

the lockout feature. If a STOP signal arrives before a START signal, the instrument will not count until it is reset and the cycle repeated in the proper sequence.

e. OPTIONAL: Manually or automatically actuate the printer upon completion of a readout cycle. The printer readout should exactly duplicate the visual display readout. Automatic print command signals for the printer may be derived from the STOP pulse. These signals should be delayed a finite period of time until counting is completed, then applied to the printer.


Regulator Q13
Regulator Q10
Regulator Q6
Regulator Q2
Fuse F2
Fuse F3
Fan
Transformer T1
1 mc Oscillator
Capacitor C2
G-14A Gate
Capacitor C5
S-99A DCU
Capacitor C8
Z-62D Reset
100X Multiplier
S-71A DCU
S-72A DCU
Oscillator Adjust
S-73 DCU


Power Switch
Stop Polarity Switch
Overflow Lamp
Start Polarity Switch
Reset Button
Resistor R19 (+)30v Adjust
S-99A Printout Code Converter
Resistor R10 (-)30v Adjust
Overflow Circuit
Capacitor C1
P.S. Regulation Board
Line Cord
P.S. Terminal Strip
Capacitor C6
Stop Channel
Start Channel
Capacitor C12

SECTION 4

CIRCUIT DESCRIPTION

4.1 MODEL 783G BLOCK DIAGRAM - DRAWING B-3-2021

In the Model 783G, the Start/Stop flip-flop controls gating of the 100 mc output from the frequency multiplier. Operating in conjunction with this circuit is the Lockout flip-flop which effectively blocks all other input signals on the Start/Stop lines when the STOP function is actuated.

After reset, an input START signal sets the Start/Stop flip-flop. The Lockout flip-flop remains in the reset condition. The two output levels thus obtained enable the AND gate which turns on the G-14A gating circuits. At this point counting begins as 100 mc signals pass to the S-99A Decade Counting Unit where a divide by ten operation occurs.

The signals are then coupled to the S-71A, S-72A and S-73 dividers where similar divide by ten operations take place. An overflow lamp turns on if the readout register exceeds its capacity.

An input STOP signal resets the Start/Stop flip-flop and drives the Lockout flip-flop to the set condition, thus causing the AND gate levels to rise and the G-14A gate circuit to close. All counting ceases until the instrument is again reset and the START function re-activated.

Reset signals are provided by high speed and low speed reset generators, the former resetting the G-14A Gate and S-99A DCU while the latter simultaneously resets all other functions. The instrument can be reset manually by the front panel push-button or remotely by a negative input signal.

The time base circuits consist of an internal or external 1 mc oscillator, and a 100 mc frequency multiplier. The base frequency of 1 mc is multiplied up to the time base frequency of 100 mc which then drives the G-14A Gate board.

See WIRING DIAGRAM D-3-2286 for detailed interconnecting information.

4.2 G-14A GATE BOARD - DRAWING C-3-1849

The G-14A Gate is a high speed current switching circuit designed to gate the 100 mc output from the frequency multiplier.

START OPERATION - A negative START pulse from the input circuit is coupled to the Start/Stop flip-flop Q9, Q10 through voltage limiting gate CR36, CR37 and R51. The flip-flop is set, thus causing the level at Q9 collector to fall to approximately the same negative value as Q8 collector. This is translated through zener diodes CR23 and CR32 into (-)1.5 volt levels on each side of AND gate CR27, CR28. This in turn applies a negative level to the base of Inhibit Gate Q3 which cuts off, causing its collector level to rise. This level change is coupled through zener diode CR8 and enables input gate CR1, CR3 and R6 through CR4. At this point 100 mc signals on connector pin L are gated to the Shaper/Driver Schmitt Trigger

Q1, Q2. The base of Q2 is biased so that only the positive portion of the input sine waves trigger the circuit. Output is taken from the collector of Q2 and coupled directly to the base of Emitter Follower Q4 which drives Complimentary Emitter Follower Q5 and Q6. The output is then coupled to the S-99A high speed counting unit.

STOP OPERATION - A negative STOP pulse from the input circuit is coupled to the Start/Stop flip-flop Q9, Q10 through voltage limiting gate CR29, CR30 and R38 causing the flip-flop to revert to the reset condition. The same input STOP pulse is simultaneously coupled to Lockout flip-flop Q7, Q8 through voltage limiting gate CR24, CR25 and R33. The flip-flop is set thus causing the level at Q8 collector to rise to approximately the same value as the Q9 collector. This is translated through zener diodes CR23 and CR32 into (+)1.5 volt levels on each side of AND gate CR27, CR28. This in turn applies a positive level to Inhibit Gate Q3, causing it to conduct thus disabling input gate CR1, CR3, CR4 and R6 to the Shaper/Driver Schmitt Trigger. When this happens, counting ceases.

LOCKOUT OPERATION - Additional pulses on either the Start or Stop input lines cannot affect gating operation since the AND gate will remain disabled because of the conduction of Q8. The instrument must be reset at this point before another measurement can be made. High speed negative reset signals from the Z-62D board reset the Lockout and Start/Stop flip-flop through R35 to CR26 and CR31.

4.3 S-99A 100 MC DECADE COUNTING UNIT* - DRAWING D-3-1856

GENERAL - The S-99A 100 mc Decade Counting Unit is a five binary, high speed current switching circuit designed to count the 100 mc gated output from the G-14A Gate board. It utilizes "Twisted Ring" logic having "N" bistable elements, all of which are successively driven to the set condition, then in the same order are driven back to the reset condition. In this case five binaries are required to handle the count of ten. Figure 4-1 illustrates the "Twisted Ring" logic of the S-99A DCU.

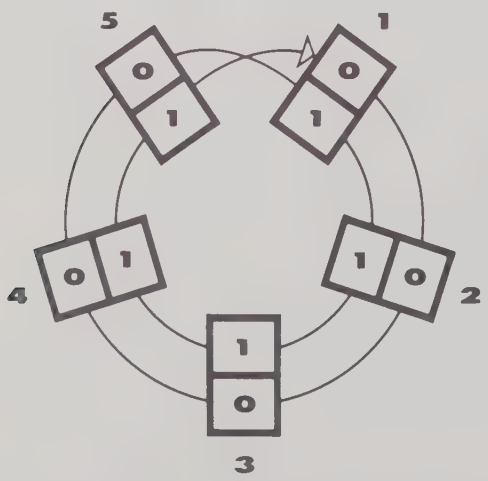


Figure 4-1. S-99A Twisted Ring Logic.

The double pulse resolution of this circuit is not limited by the resolution of any one stage since no stage is required to switch twice successively. Furthermore, only one switching action occurs at any one time which not only helps switching speed but also eliminates several critical timing problems.

Each binary counts at the speed of one fifth of the input count rate on a 50% duty cycle. Figure 4-2 shows the time relationship of input pulses to the individual binary states.

* PATENTS PENDING

DESCRIPTION - Referring to Drawing D-3-1856, all binaries are shown in the reset state with transistors Q04, Q07, Q14, Q17 and Q24 conducting. Transistors Q02, Q09, Q12, Q19 and Q22 are cutoff. Note that the S-99A schematic diagram appears to indicate alternate binary logic reversed from that shown in Figure 4-1. This is true to the extent that the S-99A circuit board layout actually conforms to that shown on the schematic diagram. Circuit logic in either case, however, is identical.

Emitter Follower transistors Q01, Q06, Q11, Q16 and Q21 are normally in a state of conduction. Gate transistors Q03, Q05, Q08, Q10, Q13, Q15, Q18, Q20, Q23 and Q25 are biased into cutoff with (+)1.3 volts generated by the current of the Emitter Follower transistors through their respective emitter resistors. Zener diodes CR01, CR02, CR03, CR04, CR05, CR06, CR07, CR08, CR09 and CR10 are 6.8 volt current fed floating collector power supplies, that translate the collector voltage swing to a plus or minus 1 volt change around ground potential depending on which binary transistor is conducting or cut off. These voltage swings are always reflected on the bases of Gates following each of the binaries.

At this point then, we begin to see that the S-99A DCU is essentially based on three input AND gate operation. This means that when switching action is to occur two of three required switching conditions will be present on all binaries, while the third condition will be present at only one binary at any one switching time.

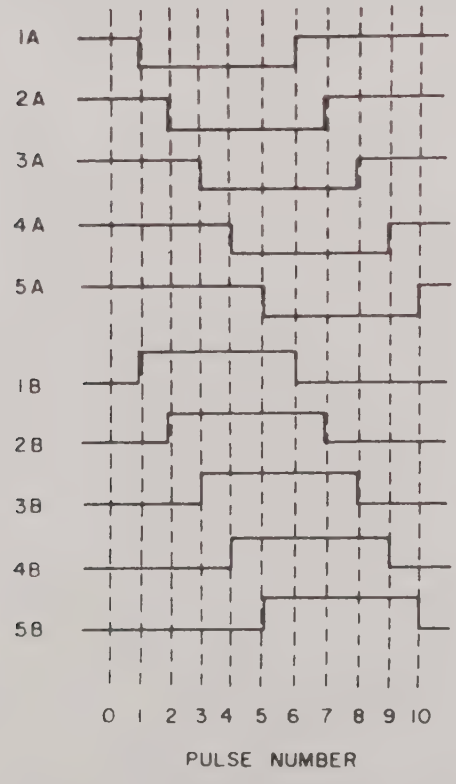


Figure 4-2. Time Relationship of Input Pulses to Binary States.

These conditions, in the order mentioned above are as follows:

CONDITION 1 - Input 100 mc signals from the G-14A Gate turn off all Emitter Followers.

CONDITION 2 - As the Emitter Followers turn off, one of the two gates in each binary conducts and attempts to switch its own binary. Four of the five binaries, however, are already switched to the desired condition therefore gate switching action has no effect on these circuits.

CONDITION 3 - At only one point in the logic ring and at any one switching time, will there be two successive binaries in the same state. When this happens the collector voltages of the binary that has just switched are of the proper polarity to open the necessary gate of the following binary so that switching action will occur. Note that when the S-99A DCU is reset, Binary #1 and Binary #5 are both in the same state thereby providing the necessary condition for Binary #1 to begin counting when time base signals are gated to the board.

OPERATION - The decade count begins when positive level changes from the G-14A board appear at connector pin E1 of the S-99A board. The first input level change cuts off all Emitter Followers thus causing their emitter currents to be transferred to the Gate of each binary which has the most negative base level, [(-)1 volt level from the collector of the non-conducting transistor in the previous binary]. Gate transistors Q03, Q08, Q15, Q18 and Q25 conduct causing a positive going level to appear at their collectors. These positive level changes are fed through the zener diode/parallel capacitor networks found at the collectors of Q02, Q07, Q14, Q17, Q24 and appear on the basis of opposite transistors in each binary. Binary #2, #3, #4 and #5 will not switch since these positive levels are being applied to the bases of transistors that are already cutoff, however, Binary #1 will switch since a positive level on the base of Q04 will drive it into cutoff thus causing a binary change in state to occur. At this point, the first positive input level from the G-14A Gate ends causing all conducting Gates to transfer their emitter currents back to the Emitter Followers.

READOUT - The visual readout count of "1" is derived from AND gate output divider, R02 and R21, which provides a positive level, (Q02 and Q07 conducting), to operate the driver transistor for the visual readout tube. No other positive output levels are present on other digit lines at this instant since alternate binary states exist elsewhere in the logic ring. A negative output level from AND gate divider R36 and R17 on the opposite side of the same binaries simultaneously provides the necessary drive for the "1" printer readout converter circuit.

The second positive level change from the G-14A board appears at the input of the S-99A board and Binary #2 now switches in the same manner, with visual readout levels being generated across AND gate output divider R35 and R53. This switching action continues from Binary #1 through Binary #5 then back through Binary #1 to Binary #5 again.

Outputs from connector pin K2 and M2 of the S-99A are coupled to the Z-62D Regenerative Differential Amplifier Q1, Q2 and Output Buffer Q7 for shaping and buffering. These output levels from the S-99A to the Z-62D Regenerative Differential Amplifier provide a square wave output which is fed to the input of the S-71A board. The negative going level of this square wave appears when the S-99A DCU reaches the count of "5", while the positive going level is provided when the count of "10" is reached. The S-71A input Channel can be triggered only by a positive going level, therefore, a "1" count is registered only when the S-99A reaches the count of "10".

4.4 S-71A 10 MC DECADE COUNTING UNIT - DRAWING D-3-1238

GENERAL - The S-71A is a 10 mc Decade Counting Unit with readout. It uses a conventional circuit of four binaries with a feedback loop between the fourth and second binaries to reduce the sixteen stable states to ten. The feedback loop contains a transistor gate in the second binary to insure zero logic in the reset state. A resistor matrix converts the four line code to a ten line decimal code and drives the self-contained visual readout circuit. Output from the S-99A is coupled to the S-71A DCU by way of the driver-buffer stages on the Z-62D board.

OPERATION - All binaries on the S-71A board are in the reset condition as the first positive going input level is simultaneously conducted to the bases of transistors

Q111 and Q112 through capacitors C101 and C104. Since transistor Q111 is conducting, it is the only element affected by the input signal. It cuts off, thus driving the binary to the set condition.

The second positive going input level is conducted to the bases of transistors Q111 and Q112. This time, transistor Q112 is the element affected by the input signal. It cuts off, thus driving the binary back to the reset state. As this happens, a positive going level change on the collector of transistor Q111 is conducted to the input of the second binary which in turn functions in the same manner as the first binary.

The third and fourth input pulses cause the first binary to generate another input pulse to the second binary, which then reverts to the reset state, thus generating a positive input level to the third binary, etc. The first, second and third binaries divide by two until the first binary has registered the count of eight. At this point a permutation occurs as the fourth binary, driven by the third binary for the first time, goes to the set condition causing transistor Q118 to conduct and transistor Q117 to cutoff. A negative going level generated at the collector of transistor Q117 feeds back through resistor R169 to the base of transistor Q119 in the second binary, driving it into conduction and effectively blocking further operation of the second and third binaries until the count of ten is reached.

At the count of nine, the first binary only changes to the set condition. The tenth input pulse causes the first binary to revert to the reset state and generate a positive going level at the collector of transistor Q111 which feeds forward to the fourth binary through capacitor C116 to input gate CR114, R164 and R166. This level cuts off transistor Q118, thus returning that binary to a reset condition. As transistor Q117 returns to a conducting state it generates a positive going output level to connector pin K which in turn is coupled directly to the input of the S-72A 1 mc DCU. This same positive going level also feeds back to the base of transistor Q119 causing it to cutoff, thus unblocking the second binary. The decade counting unit has now reached the full reset state where further input pulses will cause it to recycle again.

VISUAL READOUT - During all of the counting process, the visual indicator tube located on the same printed circuit board, displays the output from the matrix drivers. Each of the matrix drivers, Q101 through Q110, conducts when positive coincidence levels from the proper binary coded lines are applied to their respective bases. As this occurs, the visual display number associated with a particular matrix driver will fire.

PRINTER READOUT - Printer output signals in a 1-2-4-8 BCD format are available from this circuit board on the rear panel Amphenol 57-40500 connector marked PRINTER, "0" = (-)0.4 volts, "1" = (-)5.0 volts nominal.

See SECTION 7, DRAWING INDEX AND DRAWINGS for Printer Readout Connector Pin Designations.

4.5 S-72A 1 MC DECADE COUNTING UNIT - DRAWING D-3-1239

GENERAL - The S-72A is a 1 mc Decade Counting Unit with readout. It uses a con-

ventional circuit of four binaries with a feedback loop between the fourth and second binaries to reduce the sixteen stable states to ten. The feedback loop contains a transistor gate in the second binary to insure zero logic in the reset state. A resistor matrix converts the four line code to a ten line decimal code and drives the self-contained visual readout circuit. Output from the S-71A 10 mc DCU is coupled directly to the S-72A board.

OPERATION - All binaries on the S-72A board are in the reset condition as the first positive going input level is simultaneously conducted to the bases of transistors Q111 and Q112 through capacitors C101 and C104. Since transistor Q111 is conducting, it is the only element affected by the input signal. It cuts off, thus driving the binary to the set condition.

The second positive going input level is conducted to the bases of transistors Q111 and Q112. This time, transistor Q112 is the element affected by the input signal. It cuts off, thus driving the binary back to the reset state. As this happens, a positive going level change on the collector of transistor Q111 is conducted to the input of the second binary which in turn functions in the same manner as the first binary.

The third and fourth input pulses cause the first binary to generate another input pulse to the second binary, which then reverts to the reset state, thus generating a positive input level to the third binary, etc. The first, second and third binaries divide by two until the first binary has registered the count of eight. At this point a permutation occurs as the fourth binary, driven by the third binary for the first time, goes to the set condition causing transistor Q118 to conduct and transistor Q117 to cutoff. A negative going level generated at the collector of transistor Q117 feeds back through resistor R169 to the base of transistor Q119 in the second binary, driving it into conduction and effectively blocking further operation of the second and third binaries until the count of ten is reached.

At the count of nine, the first binary only changes to the set condition. The tenth input pulse causes the first binary to revert to the reset state and generate a positive going level at the collector of transistor Q111 which feeds forward to the fourth binary through capacitor C116 to input gate CR114, R164 and R166. This level cuts off transistor Q118, thus returning that binary to a reset condition. As transistor Q117 returns to a conducting state it generates a positive going output level to connector pin K which in turn is coupled directly to the input of the S-73 100 kc DCU. This same positive going level also feeds back to the base of transistor Q119 causing it to cutoff, thus unblocking the second binary. The decade counting unit has now reached the full reset state where further input pulses will cause it to recycle again.

VISUAL READOUT - During all of the counting process, the visual indicator tube located on the same printed circuit board, displays the output from the matrix drivers. Each of the matrix drivers, Q101 through Q110, conducts when positive coincidence levels from the proper binary coded lines are applied to their respective bases. As this occurs, the visual display number associated with a particular matrix driver will fire.

PRINTER READOUT - Printer output signals in a 1-2-4-8 BCD format are available from this circuit board on the rear panel Amphenol 57-40500 connector marked

PRINTER, "0" = (-)0.4 volts, "1" = (-)5.0 volts nominal.

See SECTION 7, DRAWING INDEX AND DRAWINGS for Printer Readout Connector Pin Designations.

4.6 S-73 100 KC DECADE COUNTING UNIT - DRAWING C-3-1253

GENERAL - The S-73 is a combined 100 kc Decade Counting Unit and readout. The DCU uses a conventional circuit of four binaries with a feedback loop between the fourth and second binaries to reduce the sixteen stable states to ten. A resistor matrix converts the four line code to a ten line decimal code and drives the visual readout circuit. Output from the S-72A 1 mc DCU is fed directly to the S-73 board.

OPERATION - All binaries on the S-73 board are in the reset condition as the first positive going input level is simultaneously conducted to the bases of transistors Q111 and Q112 through capacitors C101 and C104. Since transistor Q111 is conducting, it is the only element affected by the input signal. It cuts off, thus driving the binary to the set condition.

The second positive going input level is conducted to the bases of transistors Q111 and Q112. This time, transistor Q112 is the element affected by the input signal. It cuts off, thus driving the binary back to the reset state. As this happens, a positive going level change on the collector of transistor Q111 is conducted to the input of the second binary which in turn functions in the same manner as the first binary.

The third and fourth input pulses cause the first binary to generate another input pulse to the second binary, which then reverts to the reset state, thus generating a positive input level to the third binary, etc. The first, second and third binaries divide by two until the first binary has registered the count of eight. At this point a permutation occurs as the fourth binary, driven by the third binary for the first time, goes to the set condition causing transistor Q118 to conduct and transistor Q117 to cutoff. A negative going level generated at the collector of transistor Q117 feeds back through R169 and diode CR115 to provide a negative bias level on diode CR106. This prevents transistor Q113 from turning off and effectively blocks further operation of the second and third binaries until the count of ten is reached.

At the count of nine, the first binary only changes to the set condition. The tenth input pulse causes the first binary to revert to the reset state and generate a positive going level at the collector of transistor Q111 which feeds forward to the fourth binary through capacitor C116 to input gate CR114, R164 and R166. This level cuts off transistor Q118, thus returning that binary to a reset condition. As transistor Q117 returns to a conducting state it generates a positive going output level to connector pin K which in turn is coupled directly to the input of the next S-73 100 kc DCU or the Overflow Lamp circuit. In addition, the conduction of transistor Q117 removes the negative level from the anode of diode CR106, thus unblocking the second and third binaries. The decade counting unit has now reached the full reset state where further input pulses will cause it to recycle again.

VISUAL READOUT - During all of the counting process, the visual indicator tube located on the same printed circuit board, displays the output from the matrix drivers. Each of the matrix drivers, Q101 through Q110, conducts when positive coincidence levels from the proper binary coded lines are applied to their respective bases. As this occurs, the visual display number associated with a particular matrix driver will fire.

PRINTER READOUT - Printer output signals in a 1-2-4-8 BCD format are available from this circuit board on the rear panel Amphenol 57-40500 connector marked PRINTER, "0" = (-)0.4 volts, "1" = (-)5.0 volts nominal.

See SECTION 7, DRAWING INDEX AND DRAWINGS for Printer Readout Connector Pin Designations.

4.7 Z-62D READOUT AND RESET BOARD - DRAWING C-3-1822

GENERAL - The Z-62D board contains the S-99A output/shaper circuits, the S-99A visual readout tube and drivers, also the high and low speed reset circuitry.

S-99A OUTPUT/SHAPER CIRCUITS - Output levels from the S-99A DCU are connected to the inputs of Regenerative Differential Amplifier Q1 and Q2. Transistor Q1 is conducting when the S-99A is in the reset state. Transistor Q2 is cutoff. When the S-99A DCU commences counting and first reaches the "5" count, a reversal of output polarity from #5 binary occurs which causes transistor Q1 on the Z-62D board to cutoff and transistor Q2 to conduct. As the S-99A reaches the "10" count, transistors Q1 and Q2 return to their original states due to another polarity reversal from #5 binary.

The switching action of the Regenerative Differential Amplifier develops alternately positive and negative going levels on the collector of transistor Q2 that in turn cause output buffer Q7 to switch OFF at the "5" count and ON at the "10" count. This generates the proper input signal for the S-71A Decade Counting Unit which responds only to positive going input levels.

S-99A VISUAL READOUT - As the count proceeds through the S-99A DCU, positive outputs from the AND gate output dividers representing the numerical values, consecutively trigger readout driver transistors Q7 through Q16 which in turn drive the visual display digits. Since the output of the S-99A DCU is already in decimal form, the readout drivers operate without benefit of a code conversion matrix.

HIGH AND LOW SPEED RESET GENERATORS - The instrument may be reset by remote negative pulses supplied to a rear panel connector or manually by the front panel pushbutton marked RESET. The reset circuits consist of separate high speed and low speed elements. The former provides reset signals for the S-99A and G-14A, while the latter generates reset signals for the low speed decade counting units and overflow circuit.

A negative going input pulse on connector pin 1 causes transistor Q4 of the high speed section to conduct. It in turn, provides a positive going pulse that triggers One Shot transistor Q5 into conduction and then back into cutoff. This results in a negative output pulse on connector pin 5 having a very fast risetime.

The high speed output from Q5 resets the S-99A DCU and G-14A GATE, at the same time provides the trigger for the Low Speed Reset Generator.

The Low Speed Reset Generator is normally cutoff until the High Speed Reset Generator fires and provides a negative going pulse which causes transistor Q6 to conduct and supply a positive output pulse on connector pin 7 to reset the low speed decade counting units and overflow circuit.

When the Manual Reset button is depressed, a positive level is applied to normally conducting Inverter/Shaper Amplifier Q3 which then cuts off. In turn, it supplies a negative going level change to the input of the High Speed Reset Generator, thus initiating the normal reset cycle.

4.8 100 MC FREQUENCY MULTIPLIER - DRAWING D-3-2006

GENERAL - The 100 mc Frequency Multiplier accepts 1 mc signals from the rear panel input connector or from an internal high accuracy oscillator and produces sine wave output frequencies of 1, 10 and 100 mc.

OPERATION - Input Amplifiers Q9 and Q10 are RC coupled circuits which drive Tuned Amplifier Q1 to saturation. A small portion of the signal across the tank of Q1 is tapped off and fed through a 56 ohm resistor to the 1 mc output connector on the rear panel. Accidental shorting of this output will have no effect on circuit operation since adequate signal is always available across the tank to drive Tuned Amplifier Q2 into saturation. The signal at the collector of Q1 is coupled through a diode to the base of Q2 so that only the most negative portion of the Q1 collector swing is seen at Q2. The collector tank of Q2 is tuned to 5 mc and is driven once for every five cycles of output. The other four cycles are provided from the energy stored in the tank.

A tap from the tank of Q2 drives Tuned Amplifier Q3, the collector tank of which is tuned to 10 mc. A tap on this tank drives the 10 mc output through a 56 ohm resistor. Should the 10 mc output be shorted, sufficient power is still available in the 10 mc tank to drive Q4 to saturation. Tuned Amplifier Q4 is driven through a diode from the collector tank of Q3, which provides very short pulses from the most negative portions of the Q3 collector tank signals. The collector tank of Q4 is tuned to 50 mc, four out of every five output cycles being supplied by energy stored in the tank. A second 50 mc Tuned Amplifier stage follows Q4 and smoothes the amplitude modulation from the signal. The tap on the collector tank of Q5 drives Tuned Amplifier Q6, the collector tank of which is tuned to 100 mc. A tap on this tank drives the output Tuned Amplifier stage Q7 and Q8. Two transistors connected in parallel are necessary to provide a high output signal level to insure the most reliable operation. The output signal is tapped off the collector of Q7, Q8 and is fed to the G-14A GATE board where Start/Stop gating occurs.

4.9 OVERFLOW AND CONVERTER BOARD - DRAWING C-3-1854

GENERAL - Two separate circuit functions are located on this board. One is the Overflow Indicator Circuit, while the other is the S-99A Printout Converter. The board is mounted on the bottom side of the instrument beneath the frequency multiplier and crystal oscillator assemblies.

OVERFLOW INDICATOR CIRCUIT - The tens carry output from the last DCU in the counting chain is coupled to the input of Overflow Set/Reset flip-flop Q1 and Q2. A positive going input level turns off transistor Q1, and drives the flip-flop to the set condition. The flip-flop will remain in this condition until the instrument is again reset.

As transistor Q1 cuts off, the negative level change on its collector is coupled through resistor R7 to the base of Overflow Driver Q3, thus driving it into cutoff and causing the overflow lamp to conduct. Since the overflow lamp is in parallel with transistor Q3, it normally cannot conduct while a low impedance (Q3 conducting) is connected across it. When transistor Q3 cuts off it then acts as a high impedance, thus allowing the neon tube to fire.

A positive going reset pulse through diode CR2 turns off transistor Q2 causing the flip-flop to revert to the reset condition.

S-99A PRINTOUT CONVERTER - Numerical output data in 10 line coded format is generated in the S-99A AND gate output dividers and is coupled directly to the Z-62D for visual display. These same S-99A output lines are connected to the printout converter circuit. Referring to the diagram, it can be seen that transistors Q8 through Q16 are of the PNP type and therefore require negative going signal drive. Since the S-99A is a continuous counting ring it is possible at any count, to derive a positive output level from one side of the ring or a negative output level, five counts away on the other side of the ring.

In this case, the printout converter matrix is connected so that on the first count of the S-99A, a positive level from the "1" AND gate output divider drives the visual display. At the same instant, a negative output from the "6" AND gate divider drives transistor Q8 which conducts and generates a positive going level through diode CR3 that turns off transistor Q4. This produces a (-)5.0 volt output level which represents "1" on the 1-2-4-8 BCD lines.

On the second count of the S-99A, a positive level from the "2" AND gate output divider drives the visual display while a negative level from the "7" AND gate output divider drives transistor Q9 which conducts and provides a positive going level through diode CR4 that turns off transistor Q5. This produces a (-)5 volt output level representing "2" on the coded lines. A similar relationship also occurs between the 3-8, 4-9, 5-0, 6-1, 7-2, 8-3, 9-4 and 0-5 counts on the S-99A ring.

Diodes CR3 through CR17 are connected in matrix format for conversion of the S-99A decimal output to the four line BCD code. This output is available on the rear panel Amphenol 57-40500 connector; "0" = (-)0.4 volts, "1" = (-)5.0 volts nominal.

See SECTION 7, DRAWING INDEX AND DRAWINGS for Printer Readout, Connector Pin Designations.

4.10 POWER SUPPLY - DRAWING C-3-1841

The Model 783G power supply provides output voltages of (-)30 volts, (+)30 volts, (-)6 volts, (+)6.5 volts and (+)300 volts. It consists of five separate power supplies and an internal regulator amplifier power source.

Referring to the diagram, diodes CR1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 are connected in full wave rectifier circuits. Diode CR11 provides half wave rectification for the high voltage supply. The (-)30 volt, (+)30 volt, (-)6 volt and (+)6.5 volt power supplies each contain voltage regulator circuits. In the (-)30 volt circuit, regulator amplifier power is provided by internal power supply, CR1 and CR2. The (-)6 volt regulator amplifier is connected to the (-)6 volt output via zener diode CR17 which, due to the current drawn through it, sets a (-)9 volt operating level on its anode. Regulator amplifier power for the (+)30 volt supply is also derived from the (-)6 volt output. The operating level for the (+)6.5 volt power supply is set by zener diode CR19 which connects to the unregulated side of the (-)6 volt supply.

Output operating level of the (-)30 volt supply is adjusted by resistor R10 while the (+)30 volt supply is adjusted by resistor R19. No adjustment of the (+)6.5 volt and (-)6 volt supplies is required.

Transistors Q2, Q6, Q10 and Q13 are series regulators designed to maintain constant power supply output voltages. Transistors Q1, Q5 and Q9 are emitter followers which provide the control drive for three of these four series regulator elements. Differential amplifiers Q3 and Q4, Q7 and Q8, Q11 and Q12, sample their respective output voltages, comparing these to zener diode voltage standards CR14, CR16 and CR18. These diodes, in conjunction with the differential amplifiers produce the necessary correction signals which are coupled back through the emitter followers to the series regulator transistors.

In the regulator amplifier power supply, zener diode CR12 acts as a zener shunt regulator normally conducting current in an inverse relationship to current drawn from the power supply. The (+)300 volt power supply provides the operating potential for the visual display tubes and consists of a simple half wave rectifier circuit with capacitor filter.

The Model 783G power supply is designed to operate with 115 or 230 volt 50/60 cycle power. The unit is normally wired for 115 volt operation when shipped from the factory. It can also be supplied on special order, wired for 230 volt operation.

When 230 volt operation is desired, the power transformer primary connections must be changed from parallel to series operation. In addition, a separate 230 to 115 volt step down transformer is required to operate the crystal oven when an internal time base oscillator is contained in the instrument.

SECTION 5
MAINTENANCE

5.1 GENERAL

The Model 783G Time Interval Counter normally requires a minimum amount of maintenance, however, aging of electronic components may eventually be the cause of abnormal operation. Therefore, general maintenance and trouble shooting information is included in this section as a guide to restoring the instrument to normal operation.

5.2 MAINTENANCE

A regular program for maintenance and inspection every 4 to 6 months is recommended to effectively minimize the probability of equipment down time. The unit should be carefully checked in the following manner:

a. Remove top and bottom cover panels.

b. Make a thorough inspection of all wiring and cables. Check for frayed, loose or burned wires.

c. Check the physical integrity of all components. Look for evidence of burning or cracking, loose solder connections, leakage of insulation compound, and general physical damage.

d. Check all switches and level controls for loose or broken terminals, tight or sticking shafts, etc.

e. If the internal panel surfaces and components have an excessive amount of dust or lint deposited on them, use a low pressure stream of air to remove the foreign material.

CAUTION

DO NOT ATTEMPT TO WIPE THE CIRCUIT BOARDS OR SMALL INTERNAL COMPONENTS WITH A CLOTH SINCE DAMAGE TO THE CIRCUITS MAY RESULT.

f. Wipe the external instrument surfaces with a soft, damp cloth to remove dirt, fingerprints and other foreign material.

g. Check operation of the instrument in accordance with OPERATING INSTRUCTIONS, SECTION 3.

h. Replace the top and bottom cover panels if all checks indicate that the instrument is operating properly.

5.3 TROUBLESHOOTING

In the event that the unit becomes inoperative, it is first recommended that OPERATING INSTRUCTIONS, SECTION 3, be carefully read to insure that all conditions are present for proper operation. If after making these checks it is found that the instrument still does not function properly, it is recommended that the following troubleshooting procedures be used as a guide for isolating the problem.

Equipment required for troubleshooting consists of a triggered oscilloscope such as Tekronix Model 581 or 585, to observe circuit waveforms and a V.T.V.M. to check power supply voltages.

a. CHECK POWER SUPPLY OPERATION, DRAWING C-3-1841 No evidence of power may indicate that Power Fuse F1 on the rear panel, or Secondary Fuses F2 and F3 on the power supply chassis are blown and require replacement. As a precaution, before replacing any blown fuse, perform a power supply resistance to ground measurement with the power turned OFF to determine if a short circuit exists in the instrument. If a short circuit is evident, remove one circuit board at a time until the defective element is located.

Table 5-1. Model 783G Power Supply Voltages.

TERMINAL CONNECTIONS		VOLTAGE	TOLERANCE	REGULATION
1	RED	(+)300v	(±)30%	NONE
2	ORANGE	(+)30v	(±)300mv	(±)1%
3	ORANGE-BLACK	(-)30v	(±)300mv	(±)1%
4	BLUE	(+)6.5v	(±)500mv	(±)5%
5	BLUE-BLACK	(-)6v	(±)200mv	(±)1%
6	BLACK	GROUND	-	-

CAUTION

DO NOT REMOVE CIRCUIT BOARDS FROM THE CHASSIS WHILE THE POWER IS TURNED ON AS DAMAGE TO CIRCUIT COMPONENTS WILL RESULT.

Power supply voltages well in excess of, or lower than those specified in Table 5-1 usually indicate that components in the instrument are damaged. It must be determined whether the fault is in the plug-in circuit boards or the power

supply. To do this, first with the power turned OFF, remove all plug-in circuit boards from the instrument. Turn the power ON and note the power supply voltages on the terminal strip located in the bottom center of the power supply chassis. If all voltages are within reasonable tolerance, turn the power OFF and return the circuit boards to their normal location. Turn the power ON and check the power supply voltages again. Under normal load the voltages should be within the specified tolerances.

If power supply levels vary from those indicated, adjustment of the (-)30 volt and (+)30 volt outputs, in that order, may be necessary. Variable resistor R10 controls the (-)30 volt output while variable resistor R19 controls the (+)30 volt output.

When component failure in the power supply is evident, the following trouble-shooting procedure is recommended. Since each section of the dc power supply finds common reference to another section, some difficulty may be experienced in immediately isolating the defective section.

First, check the (-)30 volt regulator amplifier power supply for an output of (-)35 volts to ground. Next, check the (-)30 volt supply to ground, then the (-)6 volt, (+)6.5 volt and (+)30 volt supplies to ground. A problem in one of the 6 volt supplies will usually cause the other 6 volt section to appear defective. When this happens, the (+)30 volt supply may also appear to be malfunctioning. If such a condition arises and all quick check possibilities have been exhausted, it is recommended that each regulator amplifier power input be disconnected, one section at a time, starting with the (-)30 volt supply, then the (-)6 volt, (+)6.5 volt and (+)30 volt supplies, in that order. Reconnect a laboratory power supply to each of these leads. Turn the power ON and check the operation of each power supply section. This technique will usually facilitate early detection of faulty components.

Failure of the visual readout tubes to light can usually be traced to a defective 300 volt supply. This supply is a simple half wave rectifier circuit with capacitor filter that normally requires little or no maintenance.

See POWER SUPPLY, SECTION 4.10 for the circuit description.

b. CHECK RESET OPERATION, DRAWING C-3-1822 Apply power to the instrument and note the random display count on the visual indicator tubes. Depress the front panel RESET button. All visual indicator tubes should reset to a zero condition. Turn the instrument OFF then repeat the above procedure, except this time, actuate the REMOTE RESET function. Again, all visual indicator tubes should reset to the zero condition. If the first visual indicator tube (right end of the window) fails to reset, it is an indication that the High Speed Reset Generator circuit may not be functioning correctly. Should all the other visual indicator tubes fail to reset then this may indicate that the Low Speed Reset Generator circuit has failed. With the scope probe, check Z-62D connector pin 5 for a negative going high speed reset pulse and connector pin 7 for a positive going low speed reset pulse when the RESET button is depressed.

See Z-62D READOUT AND RESET BOARD, SECTION 4.7 for the circuit description.

c. CHECK 100 MC FREQUENCY MULTIPLIER OPERATION, DRAWING D-3-2006 With the instrument turned ON, and a high accuracy external or internal 1 mc signal present, connect the scope probe to pin L of the G-14A connector where the 100 mc time base signal should be seen. If the signal is not present check to insure that (+)30 volt and (-)30 volt power levels are being applied to the multiplier circuit board.

Because of the critical nature of this assembly it is recommended that no further troubleshooting be attempted unless done by a technician or engineer possessing high level experience and background. The unit may also be returned to Eldorado Electronics for checkout and repair.

See 100 MC FREQUENCY MULTIPLIER, SECTION 4.8 for the circuit description.

d. CHECK G-14A GATE OPERATION, DRAWING C-3-1849 Apply power to the instrument. Depress the RESET button and actuate the START channel. A visual count should immediately appear on the display tubes. Actuate the STOP channel and counting should immediately stop. If the gate circuit does not appear to function properly, connect the scope probe to pin L of the G-14A connector where the 100 mc time base signal should be seen. Next reset the instrument and look at pin E of the G-14A connector. No signal should appear here until the START channel is actuated. If operation appears to be normal, then actuate the STOP channel. The 100 mc time base signal on connector pin E should immediately stop.

CAUTION

DO NOT REMOVE OR ATTEMPT TO SUBSTITUTE TRANSISTORS OR OTHER COMPONENTS ON THE G-14A GATE BOARD AS THIS MAY RESULT IN UNNECESSARY AND POSSIBLY EXPENSIVE REPAIRS.

Because of the critical nature of time relationships in this assembly it is recommended at this point that the user not attempt further troubleshooting, but rather should return the G-14A Gate and S-99A DCU matched boards to Eldorado Electronics for checkout and repair.

See G-14A GATE BOARD, SECTION 4.2 for the circuit description.

e. CHECK OPERATION OF DECADE COUNTING UNITS, DRAWING D-3-1856, C-3-1822, D-3-1238, D-3-1239 and C-3-1253 The Model 783G counting process is merely the continuous division by 10 of the 100 mc time base through a series of decade boards. Each decade board produces 1 pulse out, for every 10 pulses to its input. By use of a triggered oscilloscope with an accurately calibrated variable time base it is possible to determine if the 100 mc time base is operating close to its specified frequency and if the output of each decade counting unit is one tenth the frequency of its input.

To check operation of the decade counting units, actuate the START channel and leave the instrument in a free-running condition. Attach the scope probe to connector pin N of each decade while adjusting the variable time base of the scope to the settings shown in Table 5-2. Each decade is operating correctly if a reading of 1 cycle/centimeter is indicated on the scope

graticule and the signal shown is clean and free from spurious response. If scope synchronization difficulty appears during the test, or drop-outs in the pattern occur, it may be an indication that one of the previous decades in the counting chain is not functioning properly and requires repair or replacement.

Table 5-2. Operational Check of Decades.

DECADE*	BOARD DESIGNATION	TIME BASE SETTING	OPERATING FREQUENCY	DISPLAY CALIBRATION
2	S-71A	0.1 usec	10 mc	1 cycle/cm
3	S-72A	1.0 usec	1 mc	1 cycle/cm
4	S-73	10.0 usec	100 kc	1 cycle/cm
5	S-73	0.1 msec	10 kc	1 cycle/cm
6	S-73	1.0 msec	1 kc	1 cycle/cm
7	S-73	10.0 msec	100 cps	1 cycle/cm
8	S-73	0.1 sec	10 cps	1 cycle/cm
9A	S-73	1.0 sec	1 cps	1 cycle/cm
9B	S-73	2.0 sec	0.1 cps	1 cycle/5cm

*Connector pin N on all decades except 9B, check this reading on connector pin K.

CAUTION

DO NOT REMOVE OR ATTEMPT TO SUBSTITUTE TRANSISTORS OR OTHER COMPONENTS ON THE S-99A DCU BOARD AS THIS MAY RESULT IN UNNECESSARY AND POSSIBLY EXPENSIVE REPAIRS.

Normally, S-71A, S-72A and S-73 decade counting units can be serviced in the field by local technicians or engineers. The S-99A, however, operates in a region of very critical time relationships, requiring in several instances, the selection and matching of circuit components. In addition, very few facilities possess the test equipment required for servicing and verifying the operation of this unit. For this reason, it is recommended at this point that the user not attempt further troubleshooting, but rather should return the matched S-99A DCU and G-14A Gate assemblies to Eldorado Electronics for

checkout and repair.

See S-99A DCU, SECTION 4.3; S-71A DCU, SECTION 4.4; S-72A DCU, SECTION 4.5; S-73 DCU, SECTION 4.6; Z-62D OUTPUT/SHAPER CIRCUITS, SECTION 4.7 for circuit descriptions.

f. CHECK OPERATION OF INTERNAL OSCILLATOR, OPTION B OR C With the instrument turned ON, check pin 6 of the oscillator plug-in socket for a 1 mc output signal. Operation of the internal oscillator is dependent on the (+)30 volt power supply. Check pin 5 of the oscillator plug-in socket for this level.

Should the stability of the oscillator unit be in question, check across pins 3 and 8 of the plug-in socket to determine that 115 vac oven power is present at all times. Connect an ammeter in series with the oven line to verify operation of the oven thermostat.

If calibration of the output frequency is necessary, be sure that the comparison frequency standard used has a stability level of at least 1 part in 10^9. The frequency adjustment screw is located on the top of the oscillator can and is covered by a nylon threaded cap.

5.4 FACTORY REPAIR SERVICE

In the event that any Eldorado equipment requires service and trained personnel or test equipment are not locally available, we recommend that your nearest Eldorado Sales/Service representative be contacted for information and instructions. He will make every effort to place the equipment back in good operating condition or, he may suggest that it be returned to the factory for more extensive work. Eldorado's Customer Service Department is always prepared to supply repair parts and service for any of its instruments. Equipment sent to the factory for service is usually returned to the customer within two weeks after it is received. Address all inquiries for parts and service to Eldorado Electronics, Customer Service Department, 601 Chalomar Road, Concord, California (94520).

SECTION 6
REPLACEMENT PARTS

6.1 GENERAL

This section contains necessary information for ordering of replacement parts from either Eldorado Electronics of directly from commercial sources.

To use the parts list, first refer to the column on the left side of the page where the assembly of particular interest is referenced, then read down the page until the replacement part is located. Note that complete plug-in assemblies for maintenance spares are indicated under the heading of FINAL ASSEMBLY.

Spare part recommendations are indicated in the column marked (RS), while the total quantity of any part in a given plug-in assembly is indicated in the column marked (TQ). Recommended spares include parts in such quantities to provide complete maintenance during one year of isolated service.

6.2 ORDERING INFORMATION

To order replacement parts, address all orders or inquiries directly to:

CUSTOMER SERVICE DEPARTMENT
Eldorado Electronics
601 Chalomar Road
Concord, California (94520)

When ordering, specify the following information for each part:

a. Model and complete serial number.

b. Complete part description including; the assembly designation, part designation and part number.

6.3 CODE LIST OF MANUFACTURERS

Coded manufacturer designations referenced throughout the parts list are further expanded in this section so that spare or replacement parts may be obtained directly with their respective manufacturers or vendors.

CODE LIST OF MANUFACTURERS

CODE	MANUFACTURER	ADDRESS
AB	Allen Bradley Co.	Milwaukee, Wis.
AML	Amphenol Electronics Corp.	Chicago, Ill.
ARC	ARCO Electronics Inc.	Great Neck LI,NY
BLD	Belden	Chicago, Ill.
BIR	Birnbach	New York, N. Y.
BLY	Bliley Electric Co.	Erie, Pa.
BUR	Burroughs Corp.	Philadelphia, Pa.
CAR	Carling Electric Inc.	W. Hartford, Conn.
CRL	Centralab	Milwaukee, Wis.
CTS	Chicago Telephone Supply	Elkhart, Ind.
CIJ	Cinch-Jones	Chicago, Ill.
COM'L	Commercial Vendor	
CDC	Continental Device Corp.	Hawthorne, Cal.
CDE	Cornell-Dubilier Elect.	Newark, N. J.
DAL	Dale Products	Columbus, Neb.
DEL	Delco Radio Div.	Kokomo, Ind.
ELC	ELCO Corp.	Philadelphia, Pa.
EE	Eldorado Electronics	Concord, Cal.
EPC	Electron Products Co.	Pasadena, Cal.
ELM	Elmenco (ARCO)	Los Angeles, Cal.
ERR	Erie Resistor Corp.	Erie, Pa.
FAI	Fairchild Semiconductor	Mountain View, Cal.
FER	Ferroxcube Corp.	Saugerties, N. Y.
GE	General Electric Co.	Auburn, N. Y.
GR	General Radio	West Concord, Mass.
HET	Hetherington	Sharon Hill, Pa.
IER	IERC	Burbank, Cal.
IDC	International Diode Corp.	Jersey City, N. J.
JFD	J. F. D. Electronics Corp.	Brooklyn, N. Y.
LIT	Littlefuse, Inc.	Des Plaines, Ill.
MIL	Miller, J. W.	Los Angeles, Cal.
MOT	Motorola	Scottsdale, Ariz.
PEM	Penn. Eng. & Mfg. Corp.	Doylestown, Pa.
PLC	Philco	Lansdale, Pa.
ROT	Rotron	Hasbrouck, La.
SAN	Sangamo Electric Co.	Springfield, Ill.
SEA	Sealectro	Mamaroneck, N. Y.
SEM	Semtech	Newbury Park, Cal.
SLO	Sloan	Sun Valley, Cal.
SMH	Smith, H. H.	Brooklyn, N. Y.
SPR	Sprague Electric Co.	Los Angeles, Cal.
TI	Texas Instrument Inc.	Dallas, Texas
THM	Thermolly	Dallas, Texas
TRS	Transitron Electric Corp.	Wakefield, Mass.
USE	U. S. Engineering Co., Inc.	Van Nuys, Cal.
VIK	Viking Industries	Canoga Park, Cal.
WSC	Wescap (SFE)	San Fernando, Cal.
WIL	Wilco	Indianapolis, Ind.

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
FINAL	Front Panel Assembly	EE	10-1944	1			
	Indicator Chassis Assembly	EE	10-1970	1			
	Middle Chassis Assembly	EE	10-1969	1			
	Power Supply Assembly	EE	10-1911	1	1		
	Rear Panel Assembly	EE	10-1971	1			
	G-14A P.C. Board Assembly	EE	10-1867	1	1		
	S-99A P.C. Board Assembly	EE	10-1783	1	1		
	Z-62D P.C. Board Assembly	EE	10-1647	1	1		
	S-71A P.C. Board Assembly	EE	10-1399	1	1		
	S-72A P.C. Board Assembly	EE	10-1400	1	1		
	S-73 P.C. Board Assembly	EE	10-1401	4	1		
	100 mc Frequency Multiplier Assembly	EE	10-1933	1	1		
	Converter P.C. Board Assembly	EE	10-1852	1	1		
	Gusset, Right Side	EE	C-5-1361-2	1			
	Gusset, Left Side	EE	C-5-1361-1	1			
	Shield Plate	EE	C-5-1359	2			
	Cable, Main	EE	D-2-1975	1			
	Handle	USE	1010-12	2			
	Cable, Printout	EE	C-2-1984	1			
	Screw, Pan Head 10-32 x 5/8"	COM'L		4	4		
	Screw, Pan Head 8-32 x 3/8"	COM'L		18	18		
	Screw, Flat Head 4-40 x 1/4"	COM'L		14	14		
	Screw, Pan Head 6-32 x 3/8"	COM'L		1	1		
	Nut, Kep 6-32	COM'L		1	1		
	Nut, Speed 4-40	COM'L		14	14		
	Washer, #6	COM'L		1	1		
	Washer, Lock #10	COM'L		4	4		
	Washer, Lock #8	COM'L		18	18		
	Clamp, Cable	COM'L		1	1		
	Option B: Oscillator, 10^7 Stability	BLY	CCO-7SA-2	1	1		
	Option C: Oscillator, 10^8 Stability	BLY	CCO-7MA-2	1	1		
	Option M: Connector, Front Panel	GR	874-P	2	2		

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
FINAL (Cont'd)	Option S: Fuse, 3/4A - S.B.	LIT		1	10		
	Transformer	EE	B-21-1567	1	1		
FRONT PANEL	Bezel	EE	C-5-1373	1			
	Bezel Filter	EE	A-5-1363	1	1		
	Bezel, Switch	EE	B-12-1056	4	4		
	Switch, Toggle DPDT	EE	13-1009	3	1		
	Switch, Push Button SPST	HET	B-2002	1	1		
	Indicator Light	SLO	858-R-NE2E	1	1		
	Decimal Light	EE	A-2-1336	1	1		
	Resistor, 120K 1/2W 5%	AB		1	1		
	Ferrite Toroid	FER	208F125-102	2	2		
	Fuse Clip	LIT	121002XX	1	1		
	Screw, 4-40 x 1/4"	COM'L		4	4		
	Screw, Self Tapping #6 x 1/2"	COM'L		2	2		
MIDDLE CHASSIS	Mounting Bracket, Oscillator	EE	C-5-1876	1			
	Clamp, Oscillator	EE	B-5-1874	1			
	Connector, P.C. Board 15 Pin	EE	15-1005	3	3		
	Socket, Octal	CIJ	8AM	1	1		
	Spacer, Threaded 6-32 x 1/2"	COM'L		4	4		
	Screw, 6-32 x 1/4"	COM'L		8	8		
	Washer, Lock #6	COM'L		8	8		
	Screw, 8/32 x 3/8"	COM'L		5	5		
	Nut, Pem 8/32	PEM	CL-832-2	9	9		
	Rivet, 1/8" Tubular x 3/8"	COM'L		6	6		
	Grommet, 1"	COM'L		1	1		
	Nut, Kep #6	COM'L		3	3		
	Washer, Lock #8	COM'L		5	5		
	Rivet, 1/8" Tubular x 3/16"	COM'L		2	2		
INDICATOR CHASSIS	Connector, P.C. Board 15 Pin	EE	15-1005	6	2		
	Connector, P.C. Board 30 Pin	EE	15-1006	1	1		
	Support, High Speed Circuit	EE	A-5-1701	1			

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
INDICATOR CHASSIS (Cont'd)	Cushion, High Speed Circuit Support	EE	A-5-1700	1			
	Screw, 8-32 x 3/8"	COM'L		2	2		
	Nut, Pem 8-32	PEM		6	6		
	Rivet, 1/8" Tubular x 3/8" LG	COM'L		18	18		
	Washer, Lock #8	COM'L		2	2		
REAR PANEL	Fan, Muffin "Venturi Fan"	ROT		1	1		
	Screen	EE	B-12-1084-2	1	1		
	Connector, 50 Pin "Blue Ribbon"	AML	57-40500	1	1		
	Connector, Coax	GR	874-PL	2	2		
	Connector, BNC	COM'L	UG1094/U	4	4		
	Switch, Slide SPDT	CAR	S60BL	1	1		
	Fuse Holder, 3AG	LIT		1	1		
	Fuse, 3AG 1.5 amp S.B.	LIT		1	10		
	Line Cord, 3 Wire 6'	BLD	Z-824	1	1		
	Strain Relief	COM'L		1	1		
	Screw, 6-32 x 1/2"	COM'L		4	4		
	Nut, Kep 6-32	COM'L		4	4		
	Screw, 2-56 x 3/8"	COM'L		2	2		
	Nut, 2-56	COM'L		2	2		
	Washer, Lock 2-56	COM'L		2	2		
	Rivet, 1/8" Tubular x 3/16"	COM'L		2	2		
	Washer, #6	COM'L		4	4		
	Washer, #6 x 1/16" Thick	COM'L		4	4		
G-14A GATE	P.C. Board, (Blank)	EE	D-5-1639	1	1		
	Resistor, 22 ohm 1/4W 5%	AB		1	1		
	Resistor, 82 ohm 1/4W 5%	AB		1	1		
	Resistor, 100 ohm 1/4W 5%	AB		6	2		
	Resistor, 120 ohm 1/4W 5%	AB		1	1		
	Resistor, 6.8K 1/4W 5%	AB		1	1		
	Resistor, 10K 1/4W 5%	AB		1	1		
	Resistor, 15K 1/4W 5%	AB		4	1		
	Resistor, 27K 1/4W 5%	AB		1	1		

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
G-14A GATE (Cont'd)	Resistor, 51 ohm 1/2W 5%	AB		4	1		
	Resistor, 2.7K 1/2W 5%	AB		5	2		
	Resistor, 3.9K 1/2W 5%	AB		1	1		
	Resistor, 4.7K 1/2W 5%	AB		1	1		
	Resistor, 5.6K 1/2W 5%	AB		5	2		
	Resistor, 820 ohm 1W 5%	AB		6	2		
	Resistor, 1K 1W 5%	AB		1	1		
	Resistor 1.2K 1W 5%	AB		4	1		
	Resistor, 1.5K 1W 5%	AB		1	1		
	Resistor, 1.8K 1W 5%	AB		3	1		
	Resistor, 2.2K 1W 5%	AB		3	1		
	Resistor, 820 ohm 2W 5%	AB		1	1		
	Resistor, 487-549 ohm 1% DC	EE	11-1857	1	1		
	Resistor, 3.3K 1/2W 1%	ARC		1	1		
	Resistor, 250 ohm 3W 3%	DAL	RLS2B	1	1		
	Inductor, .47 microhenry	WIL	201-11	4	1		
	Capacitor, 820pf (Red Cap)	WSC	RH05CW821M	10	3		
	Capacitor, .001mf 500 volt	CRL		4	1		
	Diode	EE	3-1003-2	1	1		
	Diode	CDC	CD6267	13	4		
	Diode	IDC	Q6-100	11	4		
	Diode	IDC	1D6-050T	2	1		
	Diode	EE	3-1001	1	1		
	Diode	COM'L	1N746	2	1		
	Diode	EE	3-1003-1	1	1		
	Diode	COM'L	1N754A	6	2		
	Diode	EE	3-1004	1	1		
	Transistor	FAI	2N709	3	1		
	Transistor	EE	4-1006	5	2		
	Transistor	EE	4-1005	1	1		
	Transistor	FAI	2N2368	1	1		
	Heat Sink	THM	1107	1			

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
S-99A 100 MC DCU	P.C. Board #1, (Blank)	EE	D-5-1645	1	1		
	P.C. Board #2, (Blank)	EE	D-5-1646	1	1		
	Resistor, 82 ohm 1/4W 5%	AB		10	3		
	Resistor, 120 ohm 1/4W 5%	AB		10	3		
	Resistor, 470 ohm 1/4W 5%	AB		2	1		
	Resistor, 4.7K 1/4W 5%	AB		20	7		
	Resistor, 10 ohm 1/2W 5%	AB		5	2		
	Resistor, 27 ohm 1/2W 5%	AB		10	3		
	Resistor, 120 ohm 1/2W 5%	AB		2	1		
	Resistor, 1.5K 1/2W 5%	AB		10	3		
	Resistor, 2.2K 1/2W 5%	AB		5	2		
	Resistor, 3.3K 1/2W 5%	AB		10	3		
	Resistor, 1.8K 1W 5%	AB		5	2		
	Resistor, 220 ohm 2W 5%	AB		1	1		
	Resistor, 1K 2W 5%	AB		1	1		
	Capacitor, 22pf 1kv 10%	CRL		5	2		
	Capacitor, 150pf 500 volt 10%	CRL		16	5		
	Capacitor, .001mf 1kv +80%/-20%	CRL		10	3		
	Capacitor, .01mf 50 volt	CRL		6	2		
	Diode	COM'L	1N754A	10	3		
	Diode	COM'L	1N3020B	1	1		
	Inductor, .24 microhenry	WIL	200-11	10	3		
	Transistor, Green Marking	EE	4-1006	10	3		
	Transistor, Yellow Marking	EE	4-1006	15	5		
	Sockets, Transistor	ELC	3304	25	8		
	Spacer, Phenolic 1/8 ID x .940 ±.005	EE		4	4		
	Screw, 4 x 40 x 1 1/4"	COM'L		4	4		
	Nut, Kep 4-40	COM'L		4	4		
S-71A 10 MC DCU	P.C. Board, (Blank)	EE	D-5-1335	1	1		
	Resistor, 56K 10% 1W	AB		1	1		
	Resistor, 33K 10% 1/4W	AB		8	3		
	Resistor, 10K 10% 1/4W	AB		35	12		
	Resistor, 3.9K 5% 1/4W	AB		7	2		

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
S-71A 10 MC DCU (Cont'd)	Resistor, 2.7K 5% 1/4W	AB		1	1		
	Resistor, 1.8K 10% 1/4W	AB		1	1		
	Resistor, 1.5K 5% 1/4W	AB		1	1		
	Resistor, 1.2K 5% 1/4W	AB		8	3		
	Resistor, 270 ohm 5% 1/4W	AB		8	3		
	Capacitor, 0.1mf 20 volt +80%/-20% Ceramic Disc	CRL	UK20-104	1	1		
	Capacitor, 47pf 100 volt 5% Dipped Mica	SAN	D151D470J0	7	2		
	Capacitor, 39pf 100 volt 5% Dipped Mica	SAN	D151D390J0	8	3		
	Capacitor, 27pf 100 volt 5% Dipped Mica	SAN	D151D270J0	1	1		
	Capacitor, 10pf 1kv 10% Disc Hi-Cap	CRL	CRL-DD-100	1	1		
	Diode	EE	3-1001	2	1		
	Diode	CDC	CD6267	12	4		
	Diode	TRS	S-570 G	1	1		
	Transistor	EE	4-1001	10	3		
	Transistor	EE	4-1003	9	3		
	Socket, Burroughs Indicator	BUR	SK-128	1	1		
	Tube, Indicator	BUR	6844A	1	1		
S-72A 1 MC DCU	P.C. Board, (Blank)	EE	D-5-1335	1	1		
	Resistor, 56K 10% 1W	AB		1	1		
	Resistor, 33K 10% 1/4W	AB		6	2		
	Resistor, 27K 10% 1/4W	AB		2	1		
	Resistor, 10K 10% 1/4W	AB		34	11		
	Resistor, 6.8K 10% 1/4W	AB		1	1		
	Resistor, 4.7K 10% 1/4W	AB		8	3		
	Resistor, 2.7K 10% 1/4W	AB		1	1		
	Resistor, 1.8K 10% 1/4W	AB		1	1		
	Resistor, 1.2K 10% 1/4W	AB		8	3		
	Resistor, 390 ohm 10% 1/4W	AB		8	3		
	Capacitor, 0.1 mf 20 volt +80%/-20% Ceramic Disc	CRL	UK20-104	1	1		
	Capacitor, 330pf 100 volt 5% Dipped Mica	SAN	D151D331J0	1	1		
	Capacitor, 270pf 100 volt 5% Dipped Mica	SAN	D151D271J0	4	1		
	Capacitor, 47pf 100 volt 5% Dipped Mica	SAN	D151D470J0	6	2		

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
S-72A 1 MC DCU (Cont'd)	Capacitor, 39pf 100 volt 5% Dipped Mica	SAN	D151D390J0	6	2		
	Diode	EE	3-1001	4	1		
	Diode	CDC	CD6267	10	3		
	Diode	TRS	S-570-G	1	1		
	Transistor	EE	4-1001	10	3		
	Transistor	EE	4-1002	2	1		
	Transistor	EE	4-1003	7	2		
	Socket, Burroughs Indicator	BUR	SK-128	1	1		
	Tube, Indicator	BUR	6844A	1	1		
S-73 100 KC DCU	P. C. Board, (Blank)	EE	D-5-1384	1	1		
	Resistor, 10K 1/4W 10%	AB		34	11		
	Resistor, 5.6K 1/4W 10%	AB		8	3		
	Resistor, 27K 1/4W 10%	AB		8	3		
	Resistor, 6.8K 1/4W 10%	AB		6	2		
	Resistor, 1.8K 1/4W 10%	AB		1	1		
	Resistor, 4.7K 1/4W 10%	AB		2	1		
	Resistor, 470 ohm 1/4W 10%	AB		6	2		
	Resistor, 270 ohm 1/4W 10%	AB		2	1		
	Resistor, 56K 1W 10%	AB		1	1		
	Resistor, 1K 1/4W 10%	AB		1	1		
	Capacitor, 270pf 100 volt 5%	SAN	D151D271J0	8	3		
	Capacitor, 390pf 100 volt 5%	SAN	D151D391J0	8	3		
	Capacitor, .1mf 20 volt +80%/-20%	CRL	UK20-104	1	1		
	Capacitor, .001mf 1kv 10%	CRL	DD-102	1	1		
	Diode	EE	3-1001	15	5		
	Transistor	EE	4-1002	8	3		
	Transistor	EE	4-1001	10	3		
	Socket, Burroughs Indicator	BUR	SK-128	1	1		
	Tube, Burroughs Indicator	BUR	6844A	1	1		
Z-62D RESET & READOUT	P.C. Board, (Blank)	EE	D-5-1651	1	1		
	Resistor, 22 ohm 1/4W 5%	AB		1	1		
	Resistor, 47 ohm 1/4W 5%	AB		1	1		
	Resistor, 270 ohm 1/4W 5%	AB		1	1		

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
Z-62D RESET & READOUT (Cont'd)	Resistor, 390 ohm 1/4W 5%	AB		1	1		
	Resistor, 680 ohm 1/4W 5%	AB		1	1		
	Resistor, 1K 1/4W 5%	AB		2	1		
	Resistor, 1.5K 1/4W 5%	AB		2	1		
	Resistor, 2.2K 1/4W 5%	AB		1	1		
	Resistor, 6.8K 1/4W 5%	AB		2	1		
	Resistor, 10K 1/4W 5%	AB		2	1		
	Resistor, 12K 1/4W 5%	AB		1	1		
	Resistor, 18K 1/4W 5%	AB		2	1		
	Resistor, 22K 1/4W 5%	AB		2	1		
	Resistor, 27K 1/4W 5%	AB		1	1		
	Resistor, 100K 1/4W 5%	AB		1	1		
	Resistor, 2.2K 1/2W 5%	AB		1	1		
	Resistor, 2.7K 1/2W 5%	AB		1	1		
	Resistor, 4.7K 1/2W 5%	AB		1	1		
	Resistor, 56K 1W 5%	AB		1	1		
	Resistor, 820 ohm 2W 5%	AB		1	1		
	Capacitor, 150pf Disc	SAN		5	2		
	Capacitor, 470pf Disc	SAN		1	1		
	Capacitor, .0012mf Disc	SAN		1	1		
	Capacitor, .002mf Disc	SAN		1	1		
	Capacitor, .01mf Disc	CRL		2	1		
	Capacitor, 22pf	SAN		2	1		
	Diode	CDC	CD-6267	1	1		
	Diode	EE	3-1001	9	3		
	Diode	TRS	S-570-G	1	1		
	Diode	COM'L	1N749A	1	1		
	Transistor	EE	4-1001	10	3		
	Transistor	EE	4-1002	3	1		
	Transistor	EE	4-1004	3	1		
	Transistor	MOT	2N2218	1	1		
	Inductor, 200 microhenry	DEL	1537-90	1	1		
	Inductor, 1.5 millihenry	DEL	2531-28	1	1		
	Tube, Indicator	BUR	6844A	1	1		
	Socket, Burroughs Indicator	BUR	SK-128	1	1		

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
100 MC FREQUENCY MULTIPLIER	Case, (Blank)	EE	B-5-2013	1			
	Resistor, 390 ohm ±5% 2W	AB		1	1		
	Resistor, 56 ohm ±5% 1/4W	AB		2	1		
	Resistor, 330 ohm ±5% 1/4W	AB		2	1		
	Resistor, 680 ohm ±5% 1/4W	AB		2	1		
	Resistor, 1.2K ±5% 1/4W	AB		6	2		
	Resistor, 1.5K ±5% 1/4W	AB		2	1		
	Resistor, 3.9K ±5% 1/4W	AB		11	4		
	Resistor, 4.7K ±5% 1/4W	AB		2	1		
	Resistor, 5.6K ±5% 1/4W	AB		3	1		
	Resistor, 8.2K ±5% 1/4W	AB		4	1		
	Resistor, 1K ±5% 1/4W	AB		1	1		
	Resistor, 18K ±5% 1/4W	AB		2	1		
	Diode	EE	3-1001	2	1		
	Diode	CDC	CD6267	2	1		
	Diode, Zener	MOT	3/4M12Z5	1	1		
	Terminal Board, (Blank)	EE	B-5-2014	1	1		
	Capacitor, 10pf Dipped Mica	SAN	D15-5C100J0	2	1		
	Capacitor, 18pf Dipped Mica	SAN	D15-5C180J0	1	1		
	Capacitor, 33pf Dipped Mica	SAN	D15-5E330J0	2	1		
	Capacitor, 39pf Dipped Mica	SAN	D15-5E390J0	1	1		
	Capacitor, 82pf Dipped Mica	SAN	D15-5E820J0	1	1		
	Capacitor, 100pf Dipped Mica	SAN	D15-5E101J0	2	1		
	Capacitor, 150pf Dipped Mica	SAN	D15-5E151J0	1	1		
	Capacitor, 180pf Dipped Mica	SAN	D15-5E181J0	4	1		
	Capacitor, 390pf Dipped Mica	SAN	D15-5E391J0	1	1		
	Capacitor, 470pf Dipped Mica	SAN	D15-3E471J0	2	1		
	Capacitor, 560pf Dipped Mica	SAN	D15-3E561J0	1	1		
	Capacitor, 820pf Dipped Mica	SAN	D15-3E821J0	2	1		
	Capacitor, 1000pf Dipped Mica	SAN	D15-1E102J0	2	1		
	Capacitor, 1500pf Dipped Mica	SAN	D19-5E152J0	1	1		
	Capacitor, 1800pf Dipped Mica	SAN	D19-5E182J0	1	1		
	Capacitor, 5600pf Dipped Mica	SAN	D19-3E562J0	1	1		
	Capacitor, .01mf Ceramic Disc	ERR	5835	3	1		

MODEL 783G - TIME INTERVAL COUNTER								
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS			
100 MC FREQUENCY MULTIPLIER (Cont'd)	Capacitor, .022mf Mylar	EPC	D-130-223	1	1			
	Capacitor, .22mf Ceramic Disc 50 volt	COM'L		2	1			
	Capacitor, .001mf Ceramic Disc 1000 volt	CDE	BYA10D1M	2	1			
	Capacitor, 120pf Dipped Mica	SAN	D15-5E121J0	1	1			
	Transistor	PLC	2N2374	3	1			
	Transistor	COM'L	2N1499A	2	1			
	Transistor	PLC	2N706	2	1			
	Transistor	PLC	2N2699	3	1			
	Inductor, Variable 15 microhenry	MIL	40A155CBI	1	1			
	Inductor, Variable 3.3 microhenry	MIL	40A336CBI	1	1			
	Inductor, Variable 0.47 microhenry	MIL	40A477CBI	1	1			
	Inductor, Variable 0.1 microhenry	MIL	40A107CBI	2	1			
	Tank Circuit, LC	JFD	LC375	2	1			
	Connector, Conhex Right Angle Bulkhead	SEA	3109	4	1			
	Terminal, Cloverleaf, Press Fit	SEA	FTE12	13	4			
	Spacer, .156 ID x 1/4"	EE		3	1			
	Socket, Transistor	ELC	3304	10	3			
	Terminal Block	SMH	409-3/4ST-3C	1	1			
	Spacer, Hex 3/4" x 6-32	SMH	2323	6	2			
OVERFLOW INDICATOR AND CONVERTER	P.C. Board, (Blank)	EE	E-5-1853	1	1			
	Resistor, 390 ohm 1/4W 5%	AB		2	1			
	Resistor, 1K 1/4W 5%	AB		4	1			
	Resistor, 1.5K 1/4W 5%	AB		4	1			
	Resistor, 2.2K 1/4W 5%	AB		1	1			
	Resistor, 3.9K 1/4W 5%	AB		3	1			
	Resistor, 6.8K 1/4W 5%	AB		1	1			
	Resistor, 12K 1/4W 5%	AB		4	1			
	Resistor, 33K 1/4W 5%	AB		2	1			
	Resistor, 4.7K 1/2W 5%	AB		4	1			
	Resistor, 120K 1W 5%	AB		1	1			
	Capacitor, 220pf	SAN		2	1			
	Capacitor, 390pf	SAN		1	1			
	Diode	EE	3-1001	17	6			

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
OVERFLOW INDICATOR AND CONVERTER (Cont'd)	Transistor	EE	4-1001	1	1		
	Transistor	EE	4-1002	15	5		
POWER SUPPLY	Chassis, Power Supply	EE	C-5-1835	1			
	Transformer, Power Supply	EE	C-21-1913	1	1		
	Cable	EE	C-2-1914	1	1		
	Capacitor, 1500mf 75 volt	GE	43F3055MA4	2	1		
	Capacitor, 5200mf 25 volt	GE	43F3052MA4	1	1		
	Terminal Strip	CIJ	6-170	1	1		
	Transistor	COM'L	2N379	1	1		
	Transistor	COM'L	2N1544	1	1		
	Transistor	COM'L	2N1545	2	1		
	Heat Sink, Transistor	IER	UP-T03	2			
	Heat Sink, Transistor	BIR	3AL-672	1			
	Mounting Kits, Transistor	DEL	7274775	2			
	Fuse Holder, 3AG	LIT		2	1		
	Fuse, 3AG 1 amp S.B.	LIT		2	10		
	Metal Spacer, .125 ID x 1/2 LG	EE		3	3		
	Solder Lug, #10	COM'L		6	2		
	Nuts, Kep 8-32	COM'L		4	4		
	Screw, 4-40 x 7/8" LG	COM'L		3	3		
	Screw, 4-40 x 5/8" LG	COM'L		2	2		
	Nut, Kep 4-40	COM'L		5	5		
	Nut, Pem, 8-32	PEM	CL-832-2	9	9		
	P.C. Board, (Blank)	EE	D-5-1838	1	1		
	Resistor, 150 ohm 1/4W 5%	AB		2	1		
	Resistor, 180 ohm 1/4W 5%	AB		1	1		
	Resistor, 560 ohm 1/4W 5%	AB		2	1		
	Resistor, 820 ohm 1/4W 5%	AB		1	1		
	Resistor, 1K 1/4W 5%	AB		2	1		
	Resistor, 1.5K 1/4W 5%	AB		1	1		
	Resistor, 1.8K 1/4W 5%	AB		3	1		
	Resistor, 2.2K 1/4W 5%	AB		2	1		
	Resistor, 5.6K 1/2W 5%	AB		2	1		

MODEL 783G - TIME INTERVAL COUNTER							
ASSEMBLY	DESCRIPTION	MFR.	MFR. PART #	TQ	RS		
POWER SUPPLY (Cont'd)	Resistor, 1K 1W 5%	AB		1	1		
	Resistor, 1.5K 1W 5%	AB		1	1		
	Resistor, 1K 2W W.W 5%	SPR	240E1025	2	1		
	Resistor, 3.5K 2W W.W 5%	SPR	240E3525	2	1		
	Potentiometer, 750 ohm 2W 20% W.W	CTS	BC35513	2	1		
	Capacitor, .47mf 50 volt Disc Ceramic	SPR	5C54	3	1		
	Capacitor, 2.2mf 35 volt	ELM	TS-12B-35-2.2-20	3	1		
	Capacitor, 10mf 25 volt	TI	SCM-4	1	1		
	Capacitor, 30mf 450 volt	SPR	TVA1711	1	1		
	Capacitor, 500mf 15 volt	CDE	BR-500-15	1	1		
	Capacitor, 500mf 25 volt	CDE	BR-500-25	1	1		
	Diode	SEM	SC-2	12	4		
	Diode	SEM	SC-8	1	1		
	Diode	COM'L	1N746	1	1		
	Diode	COM'L	1N751A	1	1		
	Diode	COM'L	1N753A	2	1		
	Diode	COM'L	1N754A	1	1		
	Diode	CDC	CA-3980	1	1		
	Transistor	COM'L	2N652	9	3		
	Terminal Lugs	USE	1309B-1	24	8		

SECTION 7
DRAWING INDEX AND DRAWINGS

1) Model 783G - Block Diagram B-3-2021

2) Model 783G - Wiring Diagram. D-3-2286

3) G-14A Gate - Schematic Diagram C-3-1849

4) S-99A 100 MC DCU - Schematic Diagram D-3-1856

5) Z-62D S99-A Readout and Reset-Schematic Diagram. . . C-3-1822

6) S-71A 10 MC DCU - Schematic Diagram. D-3-1238

7) S-72A 1 MC DCU - Schematic Diagram D-3-1239

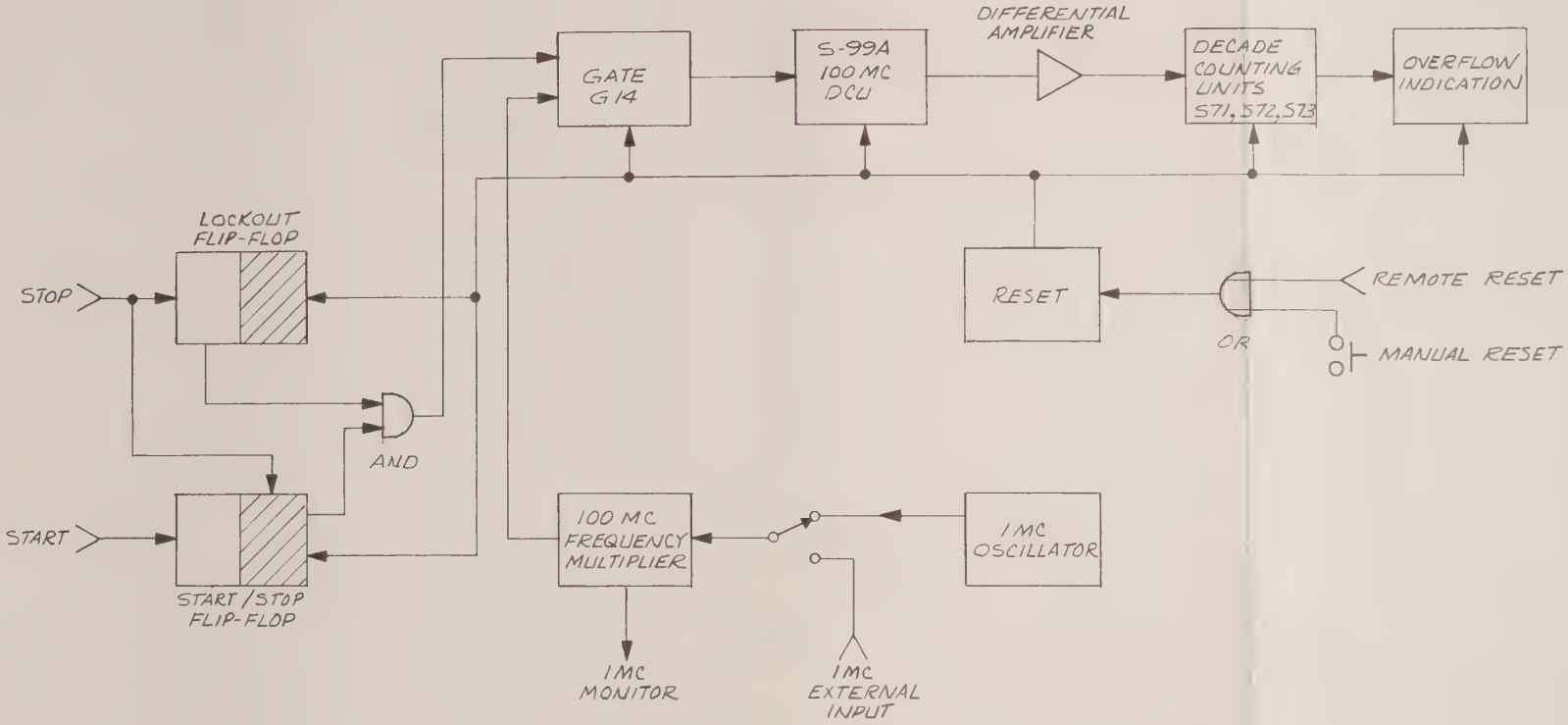
8) S-73 100 KC DCU - Schematic Diagram. C-3-1253

9) 100 MC Frequency Multiplier - Schematic Diagram. . . D-3-2006

10) Overflow and Converter - Schematic Diagram C-3-1854

11) Power Supply - Schematic Diagram C-3-1841

12) Printer Readout - Connector Pin Designations



FINISH	DWG. CHNG.	BY	DATE
MATERIAL			
TOLERANCE UNLESS NOTED ± .00 = .015 HOLE DIA. .005 .000 = .005 ANGLES 1°			

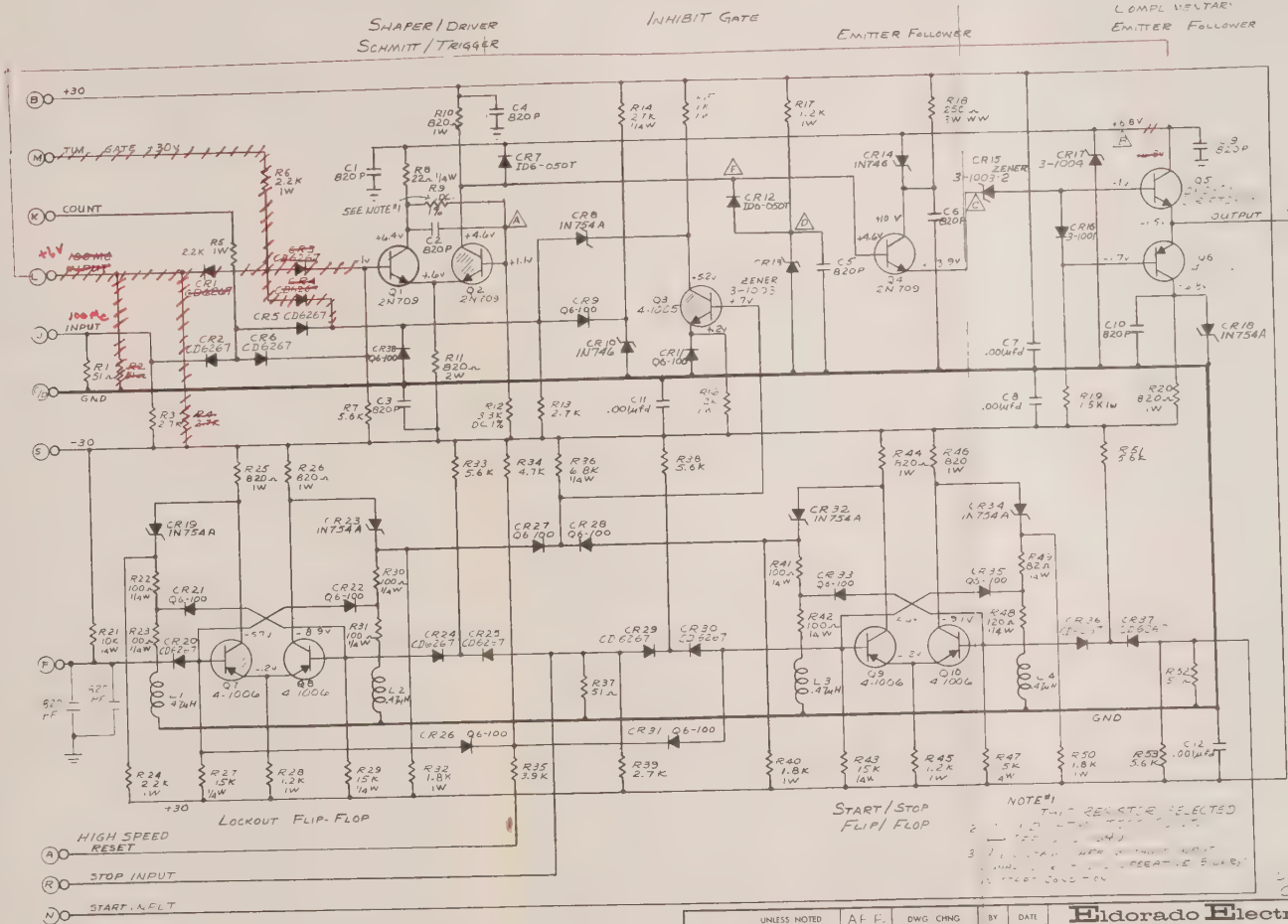
Eldorado Electronics
Berkeley, California

DRAWN BY: [illegible]	DATE 6-29-63	DO NOT SCALE THIS DRAWING.
CHECKED:	DATE	
APPROVED: WRM	DATE 6-29-63	SCALE:

BLOCK DIAGRAM

DWG. NO. B-3-2021 ISSUE

MODEL 783G



A = RESET +30
B = +30
C = GND
D = GND
E = OUTPUT
F = LOCKOUT (TO GND)
H = GND

J = COUNT INPUT (PULSE)
K = COUNT (+30)
L = ~~TIM. INPUT (OSC)~~ + 6 V
M = ~~TIM. GATE (+30)~~ OPEN
N = START INPUT (PULSE)
P = GND
R = STOP INPUT (PULSE)

S = -30

UNLESS NOTED
ALL RESISTORS ½ W ±5%
ALL CAPACITORS 500V. ±20%
ALL ZENERS 400 mw
UNITS IN Ω, F & H
μμ = p = 10^{-12}
.001μ = n = 10^{-9}
μ = 10^{-6}
m = 10^{-3}
K = 10^{3}
M = 10^{6}

A.F.	DWG. CHNG	BY	DATE

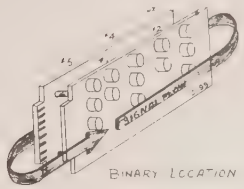
Eldorado Electronics
Berkeley, California

DRAWN BY: Sylvia DATE 3-20-63
CHECKED: [illegible] DATE [illegible]
APPROVED: [illegible] DATE 7-2-63

GATE

DWG NO C-3-1849 ISSUE

MODEL G-14A

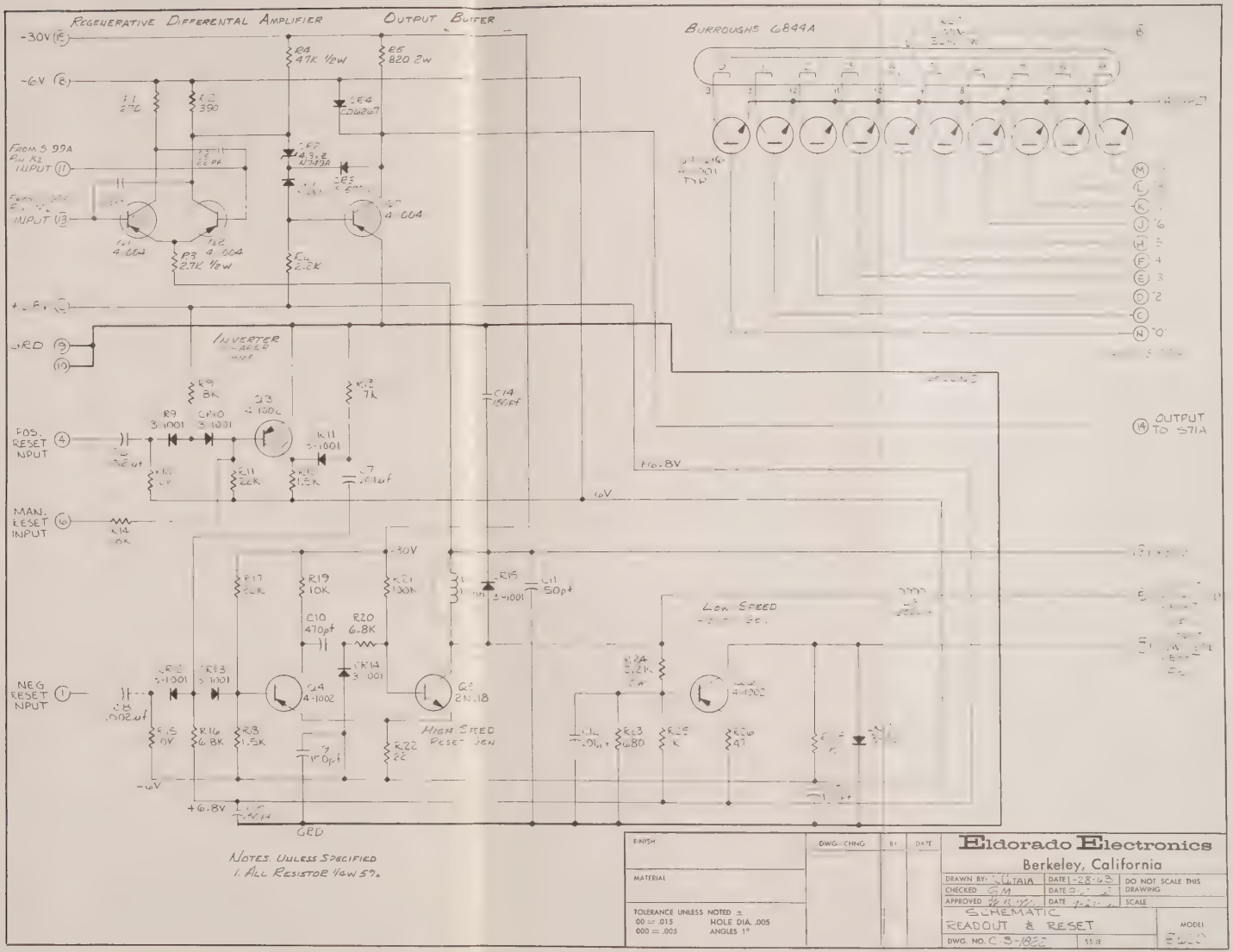


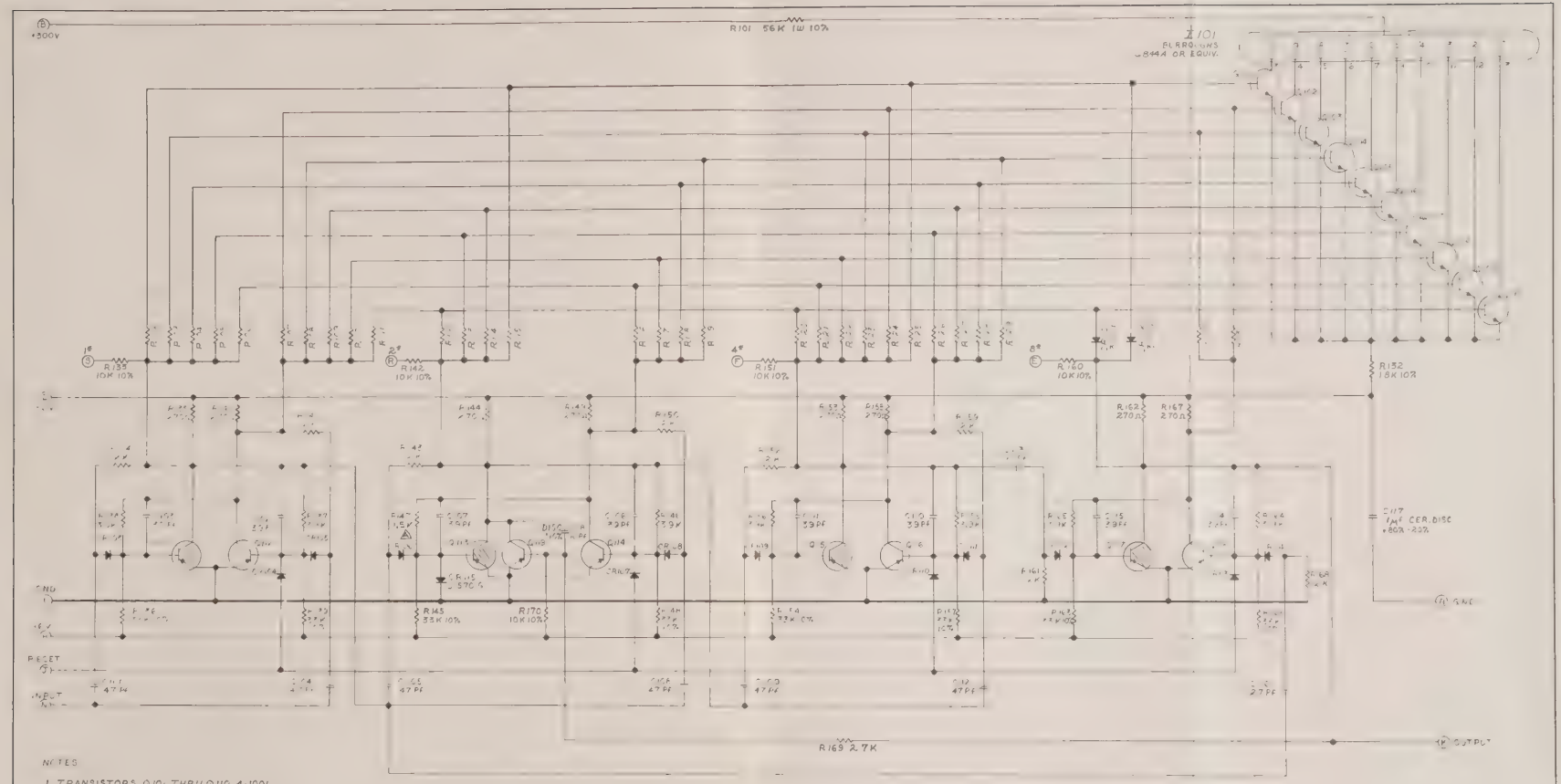
BINARY LOCATION

NOTES
1 ALL RESISTORS ARE 1/2W. UNLESS OTHERWISE NOTED.
2. ALL ZENER DIODES: 1/4M6 BZ5 OR 1N754A
3. VALUES GIVEN ON BINARY #1 ARE THE SAME FOR ALL BINARIES.
4 CONDUCTING TRANSISTORS SHOWN FOR THE RESET CONDITION

PATENT PENDING

ALL RESISTOR...	UNLESS NOTED			Eldorado Electronics
ALL CAPACITORS 300V ±20%				Berkeley, California
UNITS IN	F & H			
n	10⁻⁹			DRAWN BY
μ	10⁻⁶			CHECKED
m	10⁻³			APPROVED
—	0			100 MC DECIMAL COUNTING UNIT
K	10³			DWG NO D-3-1856
M	10⁶			MODEL S-39A

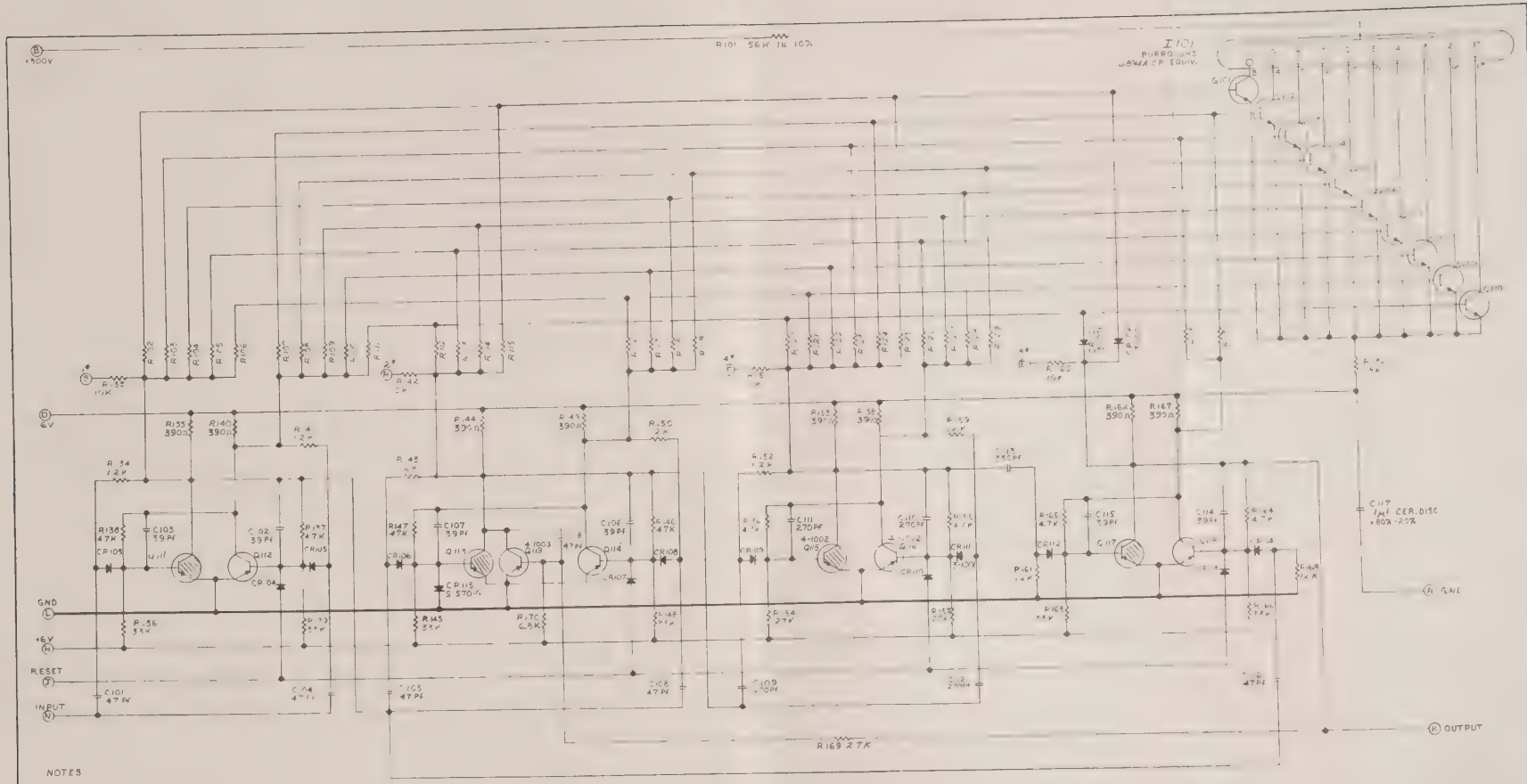

REGENERATIVE DIFFERENTIAL AMPLIFIER
OUTPUT BUFFER
BURROUGHS G844A
-30V
-6V
R4 47K ½W
E5 820 2W
FROM S 99A PIN R9 INPUT
INPUT
R3 2.7K ½W
INVERTER
+6.8V
GRD
R9 8K
R12 7K
C14 150pf
FOS. RESET INPUT
MAN. RESET INPUT
NEG RESET INPUT
C8 .002uf
R17 2.2K
R19 10K
R21 100K
C10 470pf
R20 6.8K
R15
C11 50pf
R16 6.8K
R18 1.5K
C9 150pf
R22 22
HIGH SPEED RESET GEN
LOW SPEED
R24 2.2K
R23 680
R25 K
R26 47
OUTPUT TO S71A
NOTES. UNLESS SPECIFIED
1. ALL RESISTOR ½W 5%
FINISH
MATERIAL
TOLERANCE UNLESS NOTED ±
.00 = .015
.000 = .005
HOLE DIA. .005
ANGLES 1°
DWG. CHNG
BY
DATE
Eldorado Electronics
Berkeley, California
DRAWN BY:
CHECKED
APPROVED
DATE 1-28-63
DO NOT SCALE THIS DRAWING
SCALE
SCHEMATIC
READOUT & RESET
DWG. NO. C 3-1822
MODEL



NOTES

1. TRANSISTORS Q101 THRU Q110 4-1001
   Q111 TIIRU C119 4-1002
2. RESISTORS R102 THRU R131 10K 10%
3. ALL DIODES CD6267 UNLESS NOTED
4. # OUTPUT CODE 1248 BCD
5. ⊗ P.C. TERMINATIONS

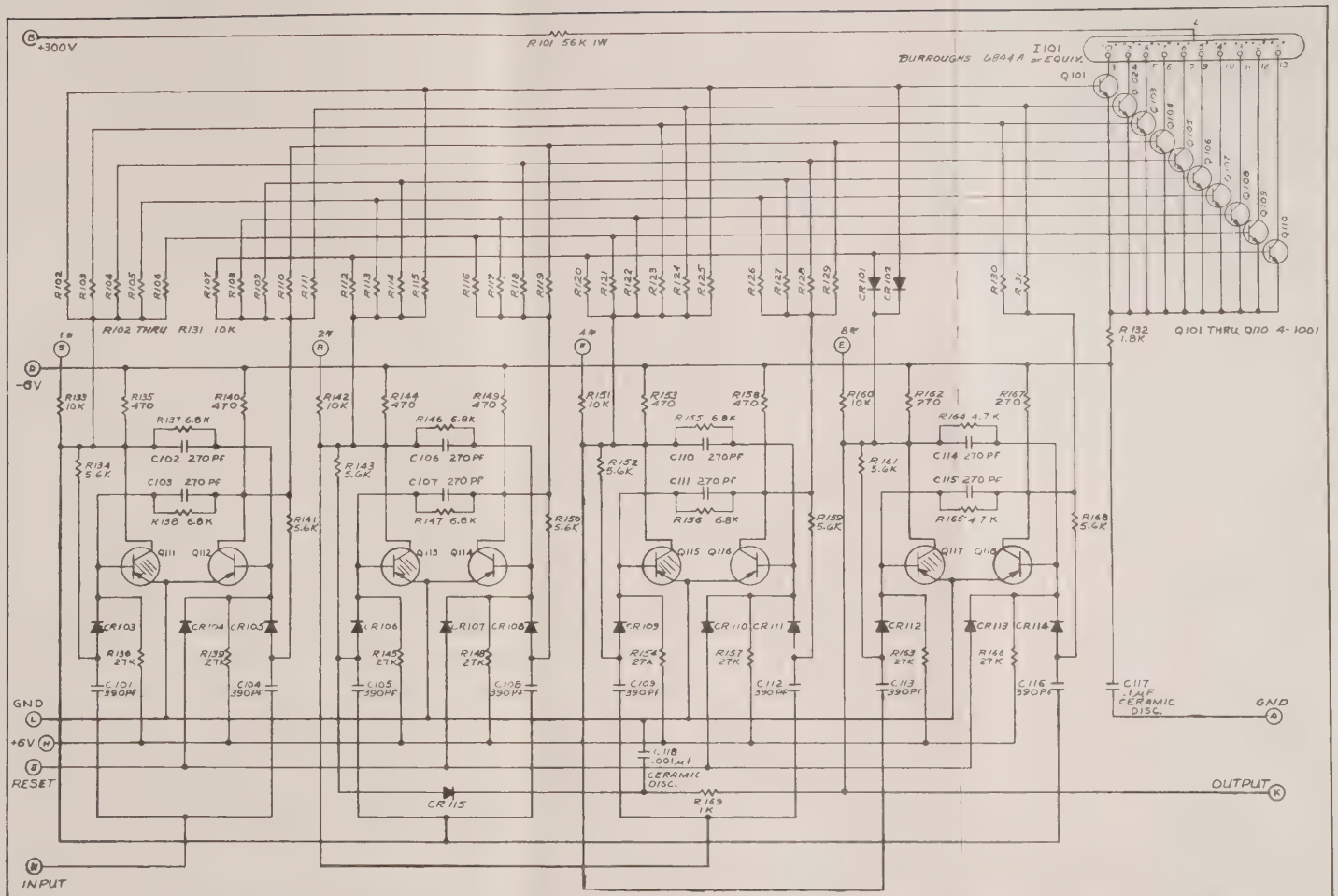
UNLESS NOTED	DWG CHNG	BY	DATE	Eldorado Electronics
ALL RESISTORS ½W ±2% 1/4W ±5%	ECO 1108		6-23-64	Berkeley, California
ALL CAPACITORS ±20% 50V.				
DRAWN BY			DATE	
CHECKED			DATE	
APPROVED			DATE	
10A1			MODEL 7/A	
DWG NO			ISSUE	

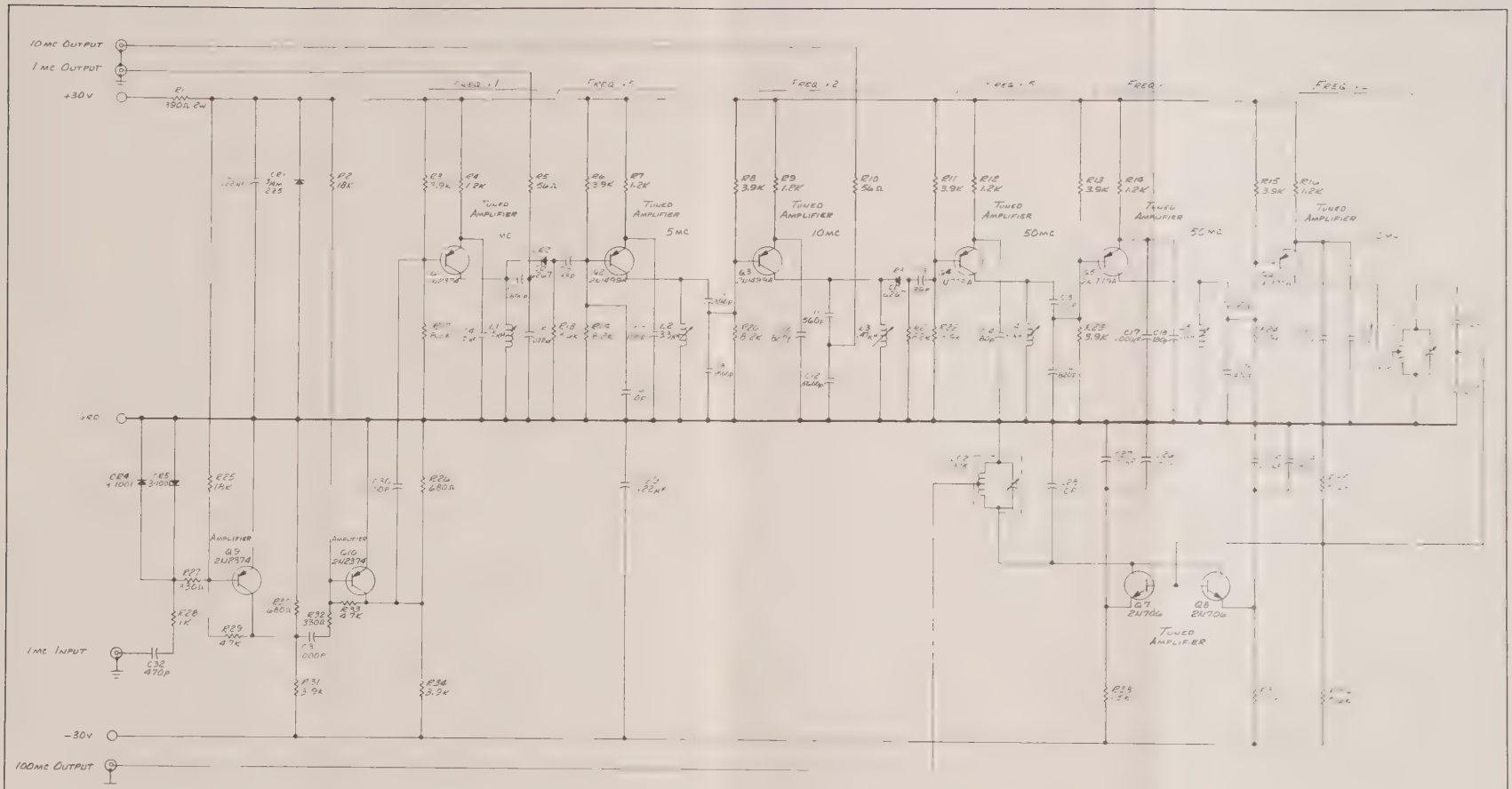


NOTES

1. TRANSISTORS Q101 THRU Q110 4-1001
   Q111 THRU Q114, Q117, 118 4-1003
2. RESISTORS R102 THRU R131 10K 10%
3. ALL DIODES CD6267 UNLESS NOTED
4. # OUTPUT CODE 1248 BCD
5. (X) P.C. TERMINATIONS

ALL RESISTORS UNLESS NOTED ±5%				Eldorado Electronics
ALL CAPACITORS ±20%				Berkeley, California
UNITS OHMS K & M				DRAWN BY [redacted] DATE
.XX ± .01				ENG. REV. [redacted] DATE
.XXX ± .005				APPR. VTC DATE
				I/M SCHEMATIC
				DWG NO. C-3-1279 ISSUE B
				MODEL S-72A


+300V
R101 56K 1W
I101
BURROUGHS 6844A or EQUIV.
Q101
R102 THRU R131 10K
R132 1.8K
Q101 THRU Q110 4-1001
-8V
GND
+6V
RESET
INPUT
OUTPUT
C117 1 MF CERAMIC DISC.
C118 .001 MF CERAMIC DISC.
CR115
R169 1K
TRANSISTORS Q111 THRU Q118 4-1002
ALL DIODES 3-1001
*OUTPUT CODE 1248 BCD
(X) P.C. TERMINATIONS
UNLESS NOTED
ALL RESISTORS ¼W ±10%
ALL CAPACITORS
UNITS IN Ω, F, & H
DWG CHNG
BY
DATE
A ECO 1077
B ECO 1113
Eldorado Electronics
Berkeley, California
DRAWN BY
CHECKED
APPROVED
DATE 12-8-61
DATE 12-18-61
DATE 12-18-61
100KC DCU SCHEMATIC
DWG. NO. C-3-1253
ISSUE B
MODEL S-73



NOTES:
1. ALL RESISTORS 1/2W 5% UNLESS SPECIFIED

UNLESS NOTED	DWG CHNG	BY	DATE
ALL RESISTORS ½W ±5%	ECO 1135	JVM	4/1/65
ALL CAPACITORS 300V ±20%			

Eldorado Electronics
Berkeley, California

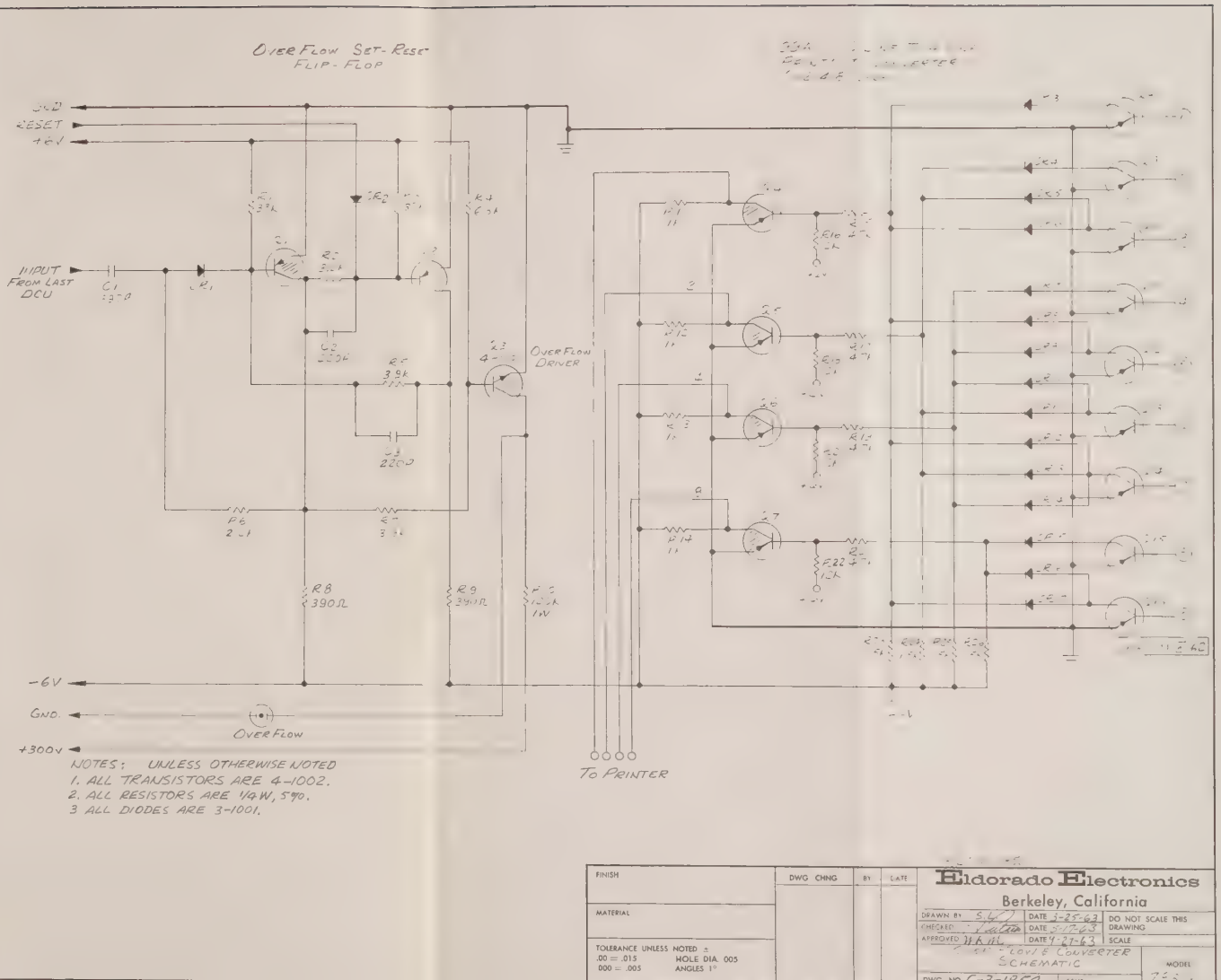
DRAWN BY	JVM	DATE 2-23
CHECKED		DATE
APPROVED		DATE

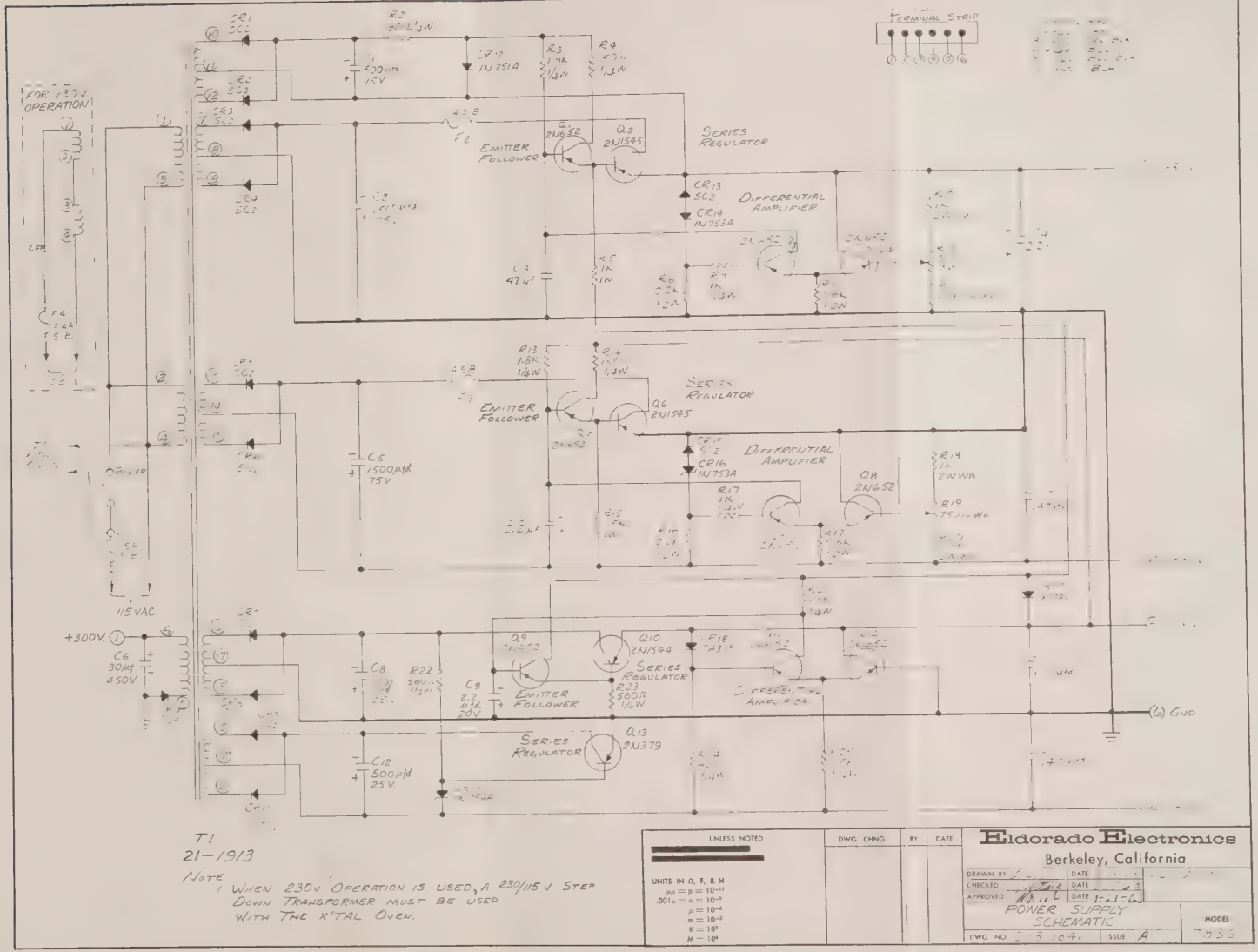
100MC FREQUENCY MULTIPLIER SCHEMATIC

DWG NO D-3-2006 SIZE D

MODEL

2 IC
9 TR
C-32
CR-5
L-5
RC-2


OVER FLOW SET-RESET
FLIP-FLOP
SET
RESET
+6V
INPUT
FROM LAST
DCU
C1
.33 D
C2
.22 D
R7
3.9k
2200
OVER FLOW
DRIVER
R8
390Ω
R9
390Ω
1W
-6V
GND.
+300V
OVER FLOW
TO PRINTER
NOTES; UNLESS OTHERWISE NOTED
1. ALL TRANSISTORS ARE 4-1002.
2. ALL RESISTORS ARE 1/4W, 5%.
3 ALL DIODES ARE 3-1001.
FINISH
MATERIAL
TOLERANCE UNLESS NOTED ±
.00 = .015 HOLE DIA .005
.000 = .005 ANGLES 1°
DWG CHNG
BY
DATE
Eldorado Electronics
Berkeley, California
DRAWN BY S.G.
DATE 3-25-63
CHECKED
DATE 3-27-63
APPROVED W.R.H.
DATE 4-27-63
DO NOT SCALE THIS DRAWING
SCALE
SCHEMATIC
DWG. NO. C-3-1854
ISSUE
MODEL



T1
21-1913

NOTE
1 WHEN 230v OPERATION IS USED, A 230/115 V STEP DOWN TRANSFORMER MUST BE USED WITH THE X'TAL OVEN.

UNLESS NOTED	DWG CHNG	BY	DATE
UNITS IN O, F, & H µµ = p = 10^{-12} .001µ = n = 10^{-9} µ = 10^{-6} m = 10^{-3} K = 10^{3} M = 10^{6}			

Eldorado Electronics
Berkeley, California

DRAWN BY	DATE
CHECKED	DATE
APPROVED	DATE 1-21-63

POWER SUPPLY SCHEMATIC

DWG NO [illegible] 1047 ISSUE A

MODEL 333

PRINTER READOUT

CONNECTOR PIN DESIGNATIONS

Connector pin designations shown below are for Amphenol #57-40500. Printout* code is 1-2-4-8 BCD; dc levels, "0" =(-)0.4 volts or less, "1" = (-)5.0 volts nominal.

DECADE	BINARY CODE			
	1	2	4	8
1**	1	2	26	27
2	3	4	28	29
3	5	6	30	31
4	7	8	32	33
5	9	10	34	35
6	11	12	36	37
7	13	14	38	39
8	15	16	40	41
9	17	18	42	43

*Print Command Output: Pin 23.

**S-99A DCU Readout on Z-62D Board.

WARRANTY

Eldorado instruments are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. This warranty does not apply to vacuum tubes or transistors, except as they are warranted by their manufacturers. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer at his expense (see Repairs) during such period and which has not been subjected to misuse, neglect, improper installation, repair, alteration, or accident. Seller shall have the right of final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warranty is in lieu of any other warranty, express, implied, or statutory, and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

RECEIVING INSPECTION

Every Eldorado instrument is carefully inspected and is in perfect working order at the time of shipment. Each instrument should be checked as soon as received. If the unit is damaged in any way or fails to operate, a claim should immediately be filed with the transportation company.

REPAIRS

When an Eldorado instrument requires service, the nearest Eldorado representative should be contacted; all representatives will provide immediate service or arrange factory returns when necessary. In the latter case, the instrument must be dispatched freight prepaid, with insurance coverage arranged by the customer. Freight and insurance on the return trip to the customer will be arranged by Eldorado and charged to the customer.

SHIPPING DAMAGES

In any case where damage occurs in transit, Eldorado's obligations under warranty are dependent on the customer's immediately notifying the carrier, so that inspection can be made and a claim filed.

Please specify both model and serial number in all correspondence concerning Eldorado instruments. Address all inquiries regarding Eldorado instruments to your nearest sales representative or Sales Manager, Eldorado Electronics Company, 601 Chalomar Road, Concord, California (94520).

MP MASTER
MA29724